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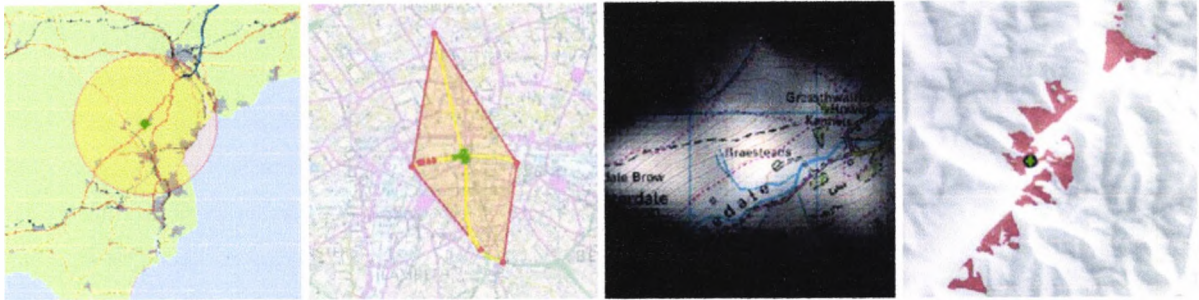
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# **Exploring mobile trajectories:**

**An investigation of individual spatial  
behaviour and geographic filters for  
information retrieval**

**David Michael Mountain**

## **Appendices**

**City University, London**

**Department of Information Science**

**School of Informatics**

**December 2005**

# Appendix 1

## **User needs evaluation: questions with a spatial reference**

The following list of 53 questions are a subset of 90 questions recorded from two user shadowing exercises, conducted as part of the WebPark project in 2001 (Krug et al., 2002).

informaton group	questions	layer	accuracy
fauna	<i>Are there any marmots here?</i>	area	5 m
	<i>Where do the animals stay usually?</i>	area	100 m
	<i>Do Ibex occur here?</i>	area	500 m
	<i>Do ibex and chamois occur together?</i>	area	500 m
	<i>Is it possible to see animals in the Ftur valley?</i>	area	500 m
	<i>Is there roe deer up here?</i>	area	500 m
	<i>What tit species do occur here?</i>	area	500 m
	<i>Is there fish in this creek?</i>	line	20 m
	<i>Is this a true ant-hill?</i>	point	5 m
flora	<i>Was this caused by 'Lothar' or by an avalanche?</i>	area	20 m
	<i>The little trees may be older as the big ones, isn't it?</i>	area	20 m
	<i>At which altitude is the timber line? Will we pass it on our way?</i>	area	20 m
	<i>Is this caused by fire?</i>	area	20 m
	<i>Is this grass regularly cut?</i>	area	20 m
	<i>Might this be named an upland moor?</i>	area	20 m
	<i>Are there also berry-bearing bushes?</i>	area	100 m
	<i>Is this a monoculture?</i>	area	100 m
	<i>Why are there only pines here?</i>	area	100 m
	<i>How old is this tree? (three times)</i>	point	5 m
landscape navigation	<i>Are we at the border of the Swiss National Park now?</i>	area	20 m
	<i>Are we now leaving the Swiss National Park?</i>	area	20 m
	<i>Is this an artificial lake?</i>	area	100 m
	<i>Is this the lake of Livigno?</i>	area	100 m
	<i>Are we arriving at Alp La Schera?</i>	area	100 m
	<i>Is this a tributary creek of the Inn river?</i>	line	20 m
	<i>What's the name of this river?</i>	line	20 m
	<i>How will the trail continue?</i>	line	20 m
	<i>Where is the trail leading to Alp La Schera?</i>	line	20 m
	<i>Which mountain is Munt La Schera?</i>	point	20 m
	<i>On what altitude are we now?</i>	point	20 m
	<i>What's the distance to the turn-off for Munt La Schera?</i>	point	20 m
	<i>Where are we? (twice)</i>	point	20 m
<i>Are we at the right parking now?</i>	point	100 m	
geomorphology	<i>Is this a moraine? (twice)</i>	area	20 m
	<i>Is this a frost phenomenon?</i>	area	20 m
	<i>Are these natural hills?</i>	area	100 m
	<i>Is permafrost an important process in this area?</i>	area	100 m
	<i>What kind of rock is this?</i>	area	100 m
	<i>What kind of caves are these? Are they artificial or natural?</i>	point	5 m
	<i>Why is this stone red?</i>	point	5 m
history	<i>Why was it necessary to cut so many trees here?</i>	area	100 m
	<i>Did the sumpter-mules also pull carts?</i>	line	5 m
research	<i>What is this pole for?</i>	area	5 m
	<i>What is this? (visible installation for research purposes)</i>	area	5 m
SNP	<i>Is this trail digged out?</i>	line	5 m
	<i>Who made this and why? (cut tree)</i>	point	5 m
	<i>What is this landmark for?</i>	point	5 m
other	<i>This doesn't look nature like. What is it?</i>	point	5 m
	<i>What is this? (mobilephone-antenna)</i>	point	20 m

# Appendix 2

**Abridged java documentation for the Spatial  
History Explorer, Dec 2005**

## SHE: all packages

A full list of all spatial history explorer classes is given below. Only a small number of the most central packages are described in more detail in the following pages. Of the classes that are described in more detail, only summary information is presented for each class. The full java documentation is available on the CD ROM accompanying this thesis, or can be downloaded from <http://www soi.city.ac.uk/~dmm/phd>.

<a href="#">edu.cu.gi.dmm.she.activity</a>
<a href="#">edu.cu.gi.dmm.she.attribute</a>
<a href="#">edu.cu.gi.dmm.she.browser</a>
<a href="#">edu.cu.gi.dmm.she.clusters</a>
<a href="#">edu.cu.gi.dmm.she.conversion</a>
<a href="#">edu.cu.gi.dmm.she.envelope</a>
<a href="#">edu.cu.gi.dmm.she.episode</a>
<a href="#">edu.cu.gi.dmm.she.general</a>
<a href="#">edu.cu.gi.dmm.she.geometry</a>
<a href="#">edu.cu.gi.dmm.she.geometry.transformation</a>
<a href="#">edu.cu.gi.dmm.she.grids</a>
<a href="#">edu.cu.gi.dmm.she.image</a>
<a href="#">edu.cu.gi.dmm.she.io</a>
<a href="#">edu.cu.gi.dmm.she.knox</a>
<a href="#">edu.cu.gi.dmm.she.mobileTrajectory</a>
<a href="#">edu.cu.gi.dmm.she.nearestNeighs</a>
<a href="#">edu.cu.gi.dmm.she.pointDensity</a>
<a href="#">edu.cu.gi.dmm.she.prediction</a>
<a href="#">edu.cu.gi.dmm.she.prediction.cwa</a>
<a href="#">edu.cu.gi.dmm.she.screen</a>
<a href="#">edu.cu.gi.dmm.she.screen.backdrop</a>
<a href="#">edu.cu.gi.dmm.she.screen.clusters</a>
<a href="#">edu.cu.gi.dmm.she.screen.color</a>
<a href="#">edu.cu.gi.dmm.she.screen.conversion</a>
<a href="#">edu.cu.gi.dmm.she.screen.frames</a>
<a href="#">edu.cu.gi.dmm.she.screen.grids</a>
<a href="#">edu.cu.gi.dmm.she.screen.interaction</a>
<a href="#">edu.cu.gi.dmm.she.screen.layout</a>
<a href="#">edu.cu.gi.dmm.she.screen.marginalia</a>
<a href="#">edu.cu.gi.dmm.she.screen.mobileTrajectory</a>
<a href="#">edu.cu.gi.dmm.she.screen.panels</a>
<a href="#">edu.cu.gi.dmm.she.screen.polys</a>
<a href="#">edu.cu.gi.dmm.she.screen.prediction</a>

<a href="#">edu.cu.gi.dmm.she.screen.timeGeog</a>
<a href="#">edu.cu.gi.dmm.she.sets</a>
<a href="#">edu.cu.gi.dmm.she.speedModel</a>
<a href="#">edu.cu.gi.dmm.she.srs</a>
<a href="#">edu.cu.gi.dmm.she.stats</a>
<a href="#">edu.cu.gi.dmm.she.subset</a>
<a href="#">edu.cu.gi.dmm.she.timeGeog</a>
<a href="#">edu.cu.gi.dmm.she.util</a>

## SHE geometry classes

For the geometry classes, first, more sophisticated point object representations than the java defaults are defined: a point in 3 spatial dimensions, a 3D point with time, and finally PointID (a 3D point with time and a unique identifier). Next a the SpatialHistory class is defined, which stores a mobile trajectory as a list of time-stamped points, with associated motion attributes such as speed, acceleration and heading. Finally exceptions are defined, to handle common errors such as trajectories that consist of only one point, or points in the trajectory that are not in the correct temporal order.

### Package edu.cu.gi.dmm.she.geometry

#### Class Summary

<a href="#"><u>ModifySpatialHistory</u></a>	Augments and/or alters the spatial history according to a number of methods.
<a href="#"><u>Point3D</u></a>	Storage class for a point with three spatial dimensionals Created on 02 Feb 2004
<a href="#"><u>Point3DT</u></a>	Storage class for a point with three spatial dimensionals and a temporal dimension Created on 02 Feb 2004
<a href="#"><u>PointID</u></a>	Encapsulates the description of a point 3D location with a timestamp (x,y,z,accuracy,srs,t) Includes a unique (integer) identifier to differentiate this point from others with the same spatial location
<a href="#"><u>SpatialHistory</u></a>	Stores the data and metadata that comprises a spatial history (a mobile trajectory of points describing an individual's movement through space over time).

#### Exception Summary

<a href="#"><u>TemporalTopologyException</u></a>	Exception when the positions in a SpatialHistory are not in temporal order
<a href="#"><u>TooFewPointsException</u></a>	Exception when there are too few points to initialise a SpatialHistory

edu.cu.gi.dmm.she.geometry

## Class Point3D

java.lang.Object

└ java.awt.geom.Point2D

└ java.awt.geom.Point2D.Double

└ edu.cu.gi.dmm.she.geometry.Point3D

### All Implemented Interfaces:

java.lang.Cloneable

### Direct Known Subclasses:

[Point3DT](#)

```
public class Point3D
extends java.awt.geom.Point2D.Double
```

Storage class for a point with three spatial dimensions

**Version:** 1.0

**Author:** David Mountain

## Nested Class Summary

### Nested classes/interfaces inherited from class java.awt.geom.Point2D

java.awt.geom.Point2D.Double, java.awt.geom.Point2D.Float

## Field Summary

double	<a href="#">accuracy</a>	An estimate of accuracy by some measure
java.lang.String	<a href="#">srs</a>	The spatial reference system used
double	<a href="#">z</a>	Stores the z (elevation) value (using some altitude measure) for a 3D point

### Fields inherited from class java.awt.geom.Point2D.Double

X, y

## Constructor Summary

[Point3D](#)(double xIn, double yIn, double zIn, double accuracyIn, java.lang.String srsIn)

Constructor initializes fields of this class using x, y and z

## Method Summary

boolean	<a href="#">equals</a> ( <a href="#">Point3D</a> p2)	Compares this Point3D with another Point3D to see if they are the same
double	<a href="#">getAccuracy</a> ()	accuracy value
double	<a href="#">getSlope</a> ( <a href="#">Point3D</a> p2)	

	Gets the slope between this point and incoming +ve if uphill from incoming to this, -ve if downhill from incoming to this
java.lang.String	<a href="#">getSrs()</a> srs value
double	<a href="#">getZ()</a> z (height) value
double	<a href="#">separation2DMetres</a> (java.awt.geom.Point2D.Double p2) Calculates the two dimensional distance between this Point and incoming (in metres)
double	<a href="#">separation2DNativeCoords</a> (java.awt.geom.Point2D.Double p2) Calculates the two dimensional distance between this position and the incoming (in native coords)
double	<a href="#">separation3DMetres</a> ( <a href="#">Point3D</a> p2) Calculates the three dimensional distance between this Point and incoming (in metres) +ve if incoming is above this point, -ve if incoming is below this point
void	<a href="#">setAccuracy</a> (double accuracyIn) set the accuracy value
void	<a href="#">setSrs</a> (java.lang.String srsIn) set the srs value
void	<a href="#">setX</a> (double xIn) set the x value
void	<a href="#">setY</a> (double yIn) set the y value
void	<a href="#">setZ</a> (double zIn) set the z (height) value
java.lang.String	<a href="#">toString()</a> Returns a String that represents the value of this Point3D.

#### Methods inherited from class java.awt.geom.Point2D.Double

getX, getY, setLocation

#### Methods inherited from class java.awt.geom.Point2D

clone, distance, distance, distance, distanceSq, distanceSq, distanceSq, equals, hashCode, setLocation

#### Methods inherited from class java.lang.Object

getClass, notify, notifyAll, wait, wait, wait

**edu.cu.gi.dmm.she.geometry**

## Class Point3DT

java.lang.Object

└ java.awt.geom.Point2D

└ java.awt.geom.Point2D.Double

└ [edu.cu.gi.dmm.she.geometry.Point3D](#)

└ edu.cu.gi.dmm.she.geometry.Point3DT

### All Implemented Interfaces:

java.lang.Cloneable

### Direct Known Subclasses:

[PointID](#)

---

```
public class Point3DT
extends Point3D
```

Storage class for a point with three spatial dimensionals and a temporal dimension  
Created on 02 Feb 2004

**Version:** 1.0

**Author:** David Mountain

## Nested Class Summary

### Nested classes/interfaces inherited from class java.awt.geom.Point2D

java.awt.geom.Point2D.Double, java.awt.geom.Point2D.Float

## Field Summary

java.util.Date [t](#)

Stores the temporal value 3DT point.

### Fields inherited from class edu.cu.gi.dmm.she.geometry.[Point3D](#)

[accuracy](#), [srs](#), [z](#)

### Fields inherited from class java.awt.geom.Point2D.Double

x, y

## Constructor Summary

[Point3DT](#)()

Empty java beans constructor

[Point3DT](#)(double xIn, double yIn, double zIn, double accuracyIn,  
java.lang.String srsIn, java.util.Date tIn)

Constructor initialises fields of this class

[Point3DT](#)([Point3DT](#) pIn)

Constructor initialises fields of this class using another point

## Method Summary

boolean [equals](#)([Point3DT](#) p2)

	Compares this Point3DT with another Point3DT to see if they are the same
java.util.Date	<a href="#">getDate()</a> Gets the timestamp for this point
double	<a href="#">getSpeed(Point3DT p2)</a> Gets the speed between this point3DT and the incoming
void	<a href="#">setDate(java.util.Date tIn)</a> sets the timestamp for this point
java.lang.String	<a href="#">toString()</a> Returns a String that represents the value of this Point3DT.

**Methods inherited from class edu.cu.gi.dmm.she.geometry.[Point3D](#)**

[equals](#), [getAccuracy](#), [getSlope](#), [getSrs](#), [getZ](#), [separation2DMetres](#), [separation2DNativeCoords](#), [separation3DMetres](#), [setAccuracy](#), [setSrs](#), [setX](#), [setY](#), [setZ](#)

**Methods inherited from class java.awt.geom.[Point2D.Double](#)**

[getX](#), [getY](#), [setLocation](#)

**Methods inherited from class java.awt.geom.[Point2D](#)**

[clone](#), [distance](#), [distance](#), [distance](#), [distanceSq](#), [distanceSq](#), [distanceSq](#), [equals](#), [hashCode](#), [setLocation](#)

**Methods inherited from class java.lang.[Object](#)**

[getClass](#), [notify](#), [notifyAll](#), [wait](#), [wait](#), [wait](#)

edu.cu.gi.dmm.she.geometry

## Class PointID

java.lang.Object

└ java.awt.geom.Point2D

└─ java.awt.geom.Point2D.Double

└─ [edu.cu.gi.dmm.she.geometry.Point3D](#)

└─ [edu.cu.gi.dmm.she.geometry.Point3DT](#)

└─ edu.cu.gi.dmm.she.geometry.PointID

### All Implemented Interfaces:

java.io.Serializable, java.lang.Cloneable

```
public class PointID
extends Point3DT
implements java.io.Serializable
```

Encapsulates the description of a point 3D location with a timestamp (x,y,z,accuracy,srs,t) Includes a unique (integer) identifier to differentiate this point from others with the same spatial location

**Version:** 0.3 09 Feb 2004

**Author:** David Mountain, City Uni London, dmm@soi.city.ac.uk

**See Also:**

[Serialized Form](#)

## Nested Class Summary

### Nested classes/interfaces inherited from class java.awt.geom.Point2D

java.awt.geom.Point2D.Double, java.awt.geom.Point2D.Float

## Field Summary

int	<a href="#">id</a>	Unique integer identifier to differentiate this point from others with the same spatial location.
-----	--------------------	---

### Fields inherited from class edu.cu.gi.dmm.she.geometry.[Point3DT](#)

[t](#)

### Fields inherited from class edu.cu.gi.dmm.she.geometry.[Point3D](#)

[accuracy](#), [srs](#), [z](#)

### Fields inherited from class java.awt.geom.Point2D.Double

[x](#), [y](#)

## Constructor Summary

[PointID](#)(int idParam, double xIn, double yIn, double zIn, double accIn, java.lang.String srsIn, java.util.Date tIn)  
Creates a new point

[PointID](#)(int idParam, [Point3DT](#) pointParam)  
Creates a new point storing the identifier and latitude/longitude location

## Method Summary

java.lang.String [toString](#)()  
This method returns the point as a string

### Methods inherited from class edu.cu.gi.dmm.she.geometry.[Point3DT](#)

[equals](#), [getDate](#), [getSpeed](#), [setDate](#)

### Methods inherited from class edu.cu.gi.dmm.she.geometry.[Point3D](#)

[equals](#), [getAccuracy](#), [getSlope](#), [getSrs](#), [getZ](#), [separation2DMetres](#),  
[separation2DNativeCoords](#), [separation3DMetres](#), [setAccuracy](#), [setSrs](#),  
[setX](#), [setY](#), [setZ](#)

### Methods inherited from class java.awt.geom.[Point2D.Double](#)

[getX](#), [getY](#), [setLocation](#)

### Methods inherited from class java.awt.geom.[Point2D](#)

[clone](#), [distance](#), [distance](#), [distance](#), [distanceSq](#), [distanceSq](#),  
[distanceSq](#), [equals](#), [hashCode](#), [setLocation](#)

### Methods inherited from class java.lang.[Object](#)

[getClass](#), [notify](#), [notifyAll](#), [wait](#), [wait](#), [wait](#)

**edu.cu.gi.dmm.she.geometry**  
**Class SpatialHistory**

java.lang.Object

└─ edu.cu.gi.dmm.she.geometry.SpatialHistory

```
public class SpatialHistory
extends java.lang.Object
```

Stores the data and metadata that comprises a spatial history (a mobile trajectory of points describing an individual's movement through space over time).

**Version:**

3.6, 10 Feb 2004

**Author:**

David Mountain; City Uni, London, dmm@soi.city.ac.uk

## Field Summary

<a href="#">LinearAttribute</a>	<a href="#">acceleration</a> LinearAttribute object storing all of the acceleration values corresponding to every position in this spatial history and associated metadata (stored as metres per second per second)
<a href="#">LinearAttribute</a>	<a href="#">accuracy</a> LinearAttribute object storing all of the accuracy values (in some units, eg hdop, units, metres) corresponding to every position in this spatial history and associated metadata
<a href="#">LinearAttribute</a>	<a href="#">altitude</a> LinearAttribute object storing all of the altitude values corresponding to every position in this spatial history and associated metadata
<a href="#">CircularAttribute</a>	<a href="#">annualDistn</a> CircularAttribute object storing the annual distribution as mSecs midnight on 1 Jan.
<a href="#">LinearAttribute[]</a>	<a href="#">attributes</a> An array of attribute objects
<a href="#">CircularAttribute</a>	<a href="#">dailyDistn</a> CircularAttribute object storing the time of day as msec since midnight.
<a href="#">LinearAttribute</a>	<a href="#">distCent</a> LinearAttribute object storing all of the distance to centroid values corresponding to every position in this spatial history and associated metadata
<a href="#">CircularAttribute</a>	<a href="#">heading</a> CircularAttribute object storing all of the heading values corresponding to every position in this spatial history and associated metadata
<a href="#">LinearAttribute</a>	<a href="#">slope</a> LinearAttribute object storing all of the slope (from -90 to +90) values corresponding to every position in this spatial history and associated metadata .
<a href="#">LinearAttribute</a>	<a href="#">speed</a> LinearAttribute object storing all of the speed values corresponding to every position in this spatial history and

	associated metadata (stored as metres per second)
java.lang.String	<u>srs</u> store somewhere outside Stores the spatial reference system
<u>LinearAttribute</u>	<u>time</u> Attribute object storing all of the milliseconds (since 1 Jan 1970) values corresponding to every position in this spatial history and associated metadata
<u>CircularAttribute</u>	<u>turningAngle</u> CircularAttribute object storing all of the turning values corresponding to every position in this spatial history and associated metadata
double	<u>walkingSpeedOnFlat</u> LinearAttribute object storing walking speed on flat ground.
<u>CircularAttribute</u>	<u>weeklyDistn</u> CircularAttribute object storing the weekly distribution as mSecs midnight on Sun/Mon.
<u>LinearAttribute</u>	<u>x</u> LinearAttribute object storing all of the x values (in some numerical Cartesian coord scheme) corresponding to every position in this spatial history and associated metadata
<u>LinearAttribute</u>	<u>y</u> LinearAttribute object storing all of the y values (in some numerical Cartesian coord scheme corresponding to every position in this spatial history and associated metadata
<u>Point3DT</u>	<u>firstPoint</u> Oldest position
<u>Point3DT</u>	<u>lastPoint</u> Most recent position
long	<u>meanSamplingRate</u> Stores the mean time interval (in milliseconds) between the collection of temporally adjacent points.
int	<u>nPoints</u> Total number of input points
java.util.List	<u>pointIdList</u> List of points as PointIDs
double	<u>sinuosity</u> Stores sinuosity for the entire set of points.
java.util.Date[]	<u>timestamps</u> Array of time stamps corresponding to the object list.
java.util.Hashtable	<u>trajectoryObjects</u> Hashtable storing all of the other screen objects associated with a single trajectory
java.lang.String	<u>userName</u> Variable holding user information

## Constructor Summary

SpatialHistory(java.lang.String srsIn, java.util.List phList)  
First constructor used in offline mode (when username not known)

[SpatialHistory](#)(java.lang.String uname, java.lang.String srsIn, net.eads.sysde.portal.userlocator.IPositionHistory iPosHist)  
 Constructor used when converting for the WebPark portal

## Method Summary

double	<a href="#">dateToRatio</a> (java.util.Date dateIn) Method to convert an absolute date/time to a ratio wrt this spatial history (if the date is within the spatial history temporal bounds, the ratio will be between 0 and 1) This method is used for spatializing the temporal values, in this case calculating the x axis of the temporal plot
double	<a href="#">dayOfWeekToRatio</a> (java.util.Date dateIn) Method to convert a day of the week to a ratio (between 0 and 1) This method is used for spatializing the temporal values, in this case calculating day of the week for the y axis of the temporal plot
double	<a href="#">dayOfWeekToRatio</a> (int dayOfWeek) Method to convert a day of the week to a ratio (between 0 and 1) This method is used for spatializing the temporal values, in this case calculating day of the week for the y axis of the temporal plot
long	<a href="#">getDuration</a> () The duration of this history in milliseconds
Java.util.Date	<a href="#">getMeanTime</a> () The mean time for the set
<a href="#">Point3DT</a>	<a href="#">latestBreakpoint</a> () Finds the latest breakpoint based on attribute (speed and direction)
Java.util.List	<a href="#">latestSeries</a> (long millisBreak) Returns the most recent series of points (that are an unbroken temporal sequence)
double	<a href="#">monthToRatio</a> (java.util.Date dateIn) Method to convert a month to a ratio (between 0 and 1) This method is used for spatializing the temporal values, in this case calculating the month for the y axis of the temporal plot
double	<a href="#">monthToRatio</a> (int month) Method to convert a month to a ratio (between 0 and 1) This method is used for spatializing the temporal values, in this case calculating the month for the y axis of the temporal plot
Java.util.Date	<a href="#">ratioToDate</a> (double ratio) Method to convert a ratio into an absolute date/time wrt this spatial history (if the ratio is between 0 and 1, the date will be within the spatial history temporal bounds,) This method is used for reverse spatializing the temporal values, in this case calculating the time associated with a location on the temporal plot
int	<a href="#">ratioToDayOfWeek</a> (double ratio) Method to convert a ratio (between 0 and 1) to a day of the week This method is used for spatializing the temporal values, in this case calculating day of the week for the y axis of the temporal plot
int	<a href="#">ratioToMonth</a> (double ratio) Method to convert a ratio (between 0 and 1) to a month (between 0-11) This method is used for spatializing the temporal values, in this case calculating the month for the y axis of the temporal plot

java.sql.Time	<a href="#"><u>ratioToTime</u></a> (double ratio) Method to convert a ratio (between 0 and 1) to a time of day This method is used for spatializing the temporal values, in this case calculating time of day for the y axis of the temporal plot
Java.util.List	<a href="#"><u>removeOutliers</u></a> (float centroidSepTol, float millisTol, float speedTol, float accelTol) Returns a subset of the original positionHistory with outliers removed
double	<a href="#"><u>timeToRatio</u></a> (java.util.Date dateIn) Method to convert time of day to a ratio (between 0 and 1) This method is used for spatializing the temporal values, in this case calculating time of day for the y axis of the temporal plot
java.lang.String	<a href="#"><u>toShortString</u></a> () A string rep of this class
java.lang.String	<a href="#"><u>toString</u></a> () A string rep of this class

<b>Methods inherited from class java.lang.Object</b>
--

equals, getClass, hashCode, notify, notifyAll, wait, wait, wait
---

**edu.cu.gi.dmm.she.geometry**  
**Class ModifySpatialHistory**

java.lang.Object

└─ edu.cu.gi.dmm.she.geometry.ModifySpatialHistory

```
public class ModifySpatialHistory
extends java.lang.Object
```

Augments and/or alters the spatial history by applying a number of methods.

**Version:** 0.6, 13 Apr 2004

**Author:** David Mountain; City Uni, London; dmm@soi.city.ac.uk

## Constructor Summary

[ModifySpatialHistory\(\)](#)

## Method Summary

static <a href="#">SpatialHistory</a>	<a href="#">degradeResolution</a> ( <a href="#">SpatialHistory</a> spatialHist, double spatialRes, double temporalRes) Degrades the spatial and temporal resolution
static <a href="#">SpatialHistory</a>	<a href="#">interpolateTemporalGaps</a> ( <a href="#">SpatialHistory</a> spatialHist, long minTemporalGap, long maxTemporalGap, double maxSpatialDistance, long temporalResolution) Interpolates temporal gaps in the spatial history according to the incoming parameters. If the specified temporal and spatial limits are not exceeded then points are inserted at the last known location at the specified temporal resolution.

### Methods inherited from class java.lang.Object

equals, getClass, hashCode, notify, notifyAll, toString, wait, wait, wait

**edu.cu.gi.dmm.she.geometry**  
**Class TemporalTopologyException**

java.lang.Object  
└─ java.lang.Throwable  
    └─ java.lang.Exception  
        └─ edu.cu.gi.dmm.she.geometry.TemporalTopologyException

**All Implemented Interfaces:**

java.io.Serializable

---

```
public class TemporalTopologyException
extends java.lang.Exception
```

Exception when the positions in a SpatialHistory are not in temporal order

**Version:** 0.1, 21 Jan 2004

**Author:** David Mountain; City Uni, London, dmm@soi.city.ac.uk

**See Also:**

[Serialized Form](#)

---

## Constructor Summary

[TemporalTopologyException\(\)](#)

Constructs a new exception with null as its detail message.

---

## Method Summary

### Methods inherited from class java.lang.Throwable

fillInStackTrace, getCause, getLocalizedMessage, getMessage, getStackTrace, initCause, printStackTrace, printStackTrace, printStackTrace, setStackTrace, toString

### Methods inherited from class java.lang.Object

equals, getClass, hashCode, notify, notifyAll, wait, wait, wait

**edu.cu.gi.dmm.she.geometry**  
**Class TooFewPointsException**

```
java.lang.Object
├─ java.lang.Throwable
│   └─ java.lang.Exception
│       └─ edu.cu.gi.dmm.she.geometry.TooFewPointsException
```

**All Implemented Interfaces:**  
java.io.Serializable

---

```
public class TooFewPointsException
extends java.lang.Exception
```

Exception when there are too few points to initialise a SpatialHistory

**Version:** 0.1, 21 Jan 2004

**Author:** David Mountain; City Uni, London, dmm@soi.city.ac.uk

**See Also:**

[Serialized Form](#)

## Constructor Summary

[TooFewPointsException](#) ()

Constructs a new exception with null as its detail message.

## Method Summary

### Methods inherited from class java.lang.Throwable

fillInStackTrace, getCause, getLocalizedMessage, getMessage, getStackTrace, initCause, printStackTrace, printStackTrace, printStackTrace, setStackTrace, toString

### Methods inherited from class java.lang.Object

equals, getClass, hashCode, notify, notifyAll, wait, wait, wait

## SHE attribute classes

The SHE attribute classes can be used to calculate, store and analyse the attributes associated a mobile trajectory. These are predominantly motion attributes such as speed, heading and acceleration. The storage classes (Attribute, LinearAttribute and CircularAttribute) are described in more detail. Classes relating to the other attribute classes relate to calculating these attributes and parameters such as quartiles and have not been described in further detail.

### Package edu.cu.gi.dmm.she.attribute

<b>Class Summary</b>	
<a href="#"><u>Attribute</u></a>	Stores the values for an attribute (as a double array) and associated metadata Only the values and number of values are stored.
<a href="#"><u>CircularAttribute</u></a>	Stores the values for a 'circular' attribute (as a double array) and associated metadata Should be used for circular attributes (as opposed to linear attributes), where values are measured on an cyclical scale from 0-360 degrees. See Brunsdon 2003, GISRUK proceedings and Cox 2003 for more on the calculation of circular statistics
<a href="#"><u>CreateAttribute</u></a>	Generates values associated with the attribute classes
<a href="#"><u>DecayFunctions</u></a>	records different decay functions that can be used when calculating values such as weighted means
<a href="#"><u>LinearAttribute</u></a>	Stores the values for a 'linear' attribute (as a double array) and associated metadata Should be used for linear attributes (as opposed to circular attributes), where values are measured on an interval/ratio scale and an unambiguous minimum, maximum, mean, standard deviation and quartiles can be identified
<a href="#"><u>Quartiles</u></a>	Methods for calculating the quartiles associated with an array of values
<a href="#"><u>WeightingParameters</u></a>	Records different parameters b which points can be weighted, eg distance weighted, time weighted

**edu.cu.gi.dmm.she.attribute**

## Class Attribute

java.lang.Object

└─ edu.cu.gi.dmm.she.attribute.Attribute

### Direct Known Subclasses:

[CircularAttribute](#), [LinearAttribute](#)

```
public class Attribute
extends java.lang.Object
```

Stores the values for an attribute (as a double array) and associated metadata. Only the values and number of values are stored. For more statistical values, use a subclass LinearAttribute or CircularAttribute TODO create different versions of variable for nominal, ordinal, interval and ratio

**Version:** 0.4, 20 Oct 2003

**Author:** David Mountain, City Uni London, dmm@soi.city.ac.uk

### See Also:

[edu.cu.gi.dmm.she.attribute.LinearAttribute](#),  
[edu.cu.gi.dmm.she.attribute.CircularAttribute](#)

## Field Summary

static double	<a href="#">NULL ATTRIBUTE VALUE</a> The null value for any attribute
---------------	--

## Constructor Summary

<a href="#">Attribute</a> (double[] values)	Constructor; sets class variables to create an instantiation of this class
---	--

## Method Summary

int	<a href="#">getTotNoValues</a> () Returns the number of values for this attribute
int	<a href="#">getTotValidValues</a> () Returns the number of values for this attribute
double	<a href="#">getValue</a> (int i) Returns the value of the 'i'th attribute
double[]	<a href="#">getValues</a> () Returns the values of this attribute

### Methods inherited from class java.lang.Object

[equals](#), [getClass](#), [hashCode](#), [notify](#), [notifyAll](#), [toString](#), [wait](#), [wait](#), [wait](#)

**edu.cu.gi.dmm.she.attribute**  
**Class LinearAttribute**

java.lang.Object

└ [edu.cu.gi.dmm.she.attribute.Attribute](#)

└ [edu.cu.gi.dmm.she.attribute.LinearAttribute](#)

---

```
public class LinearAttribute  
extends Attribute
```

Stores the values for a 'linear' attribute (as a double array) and associated metadata. Should be used for linear attributes (as opposed to circular attributes), where values are measured on an interval/ratio scale and an unambiguous minimum, maximum, mean, standard deviation and quartiles can be identified.

**Version:** 0.2, 11 May 2005

**Author:** David Mountain, City Uni London, dmm@soi.city.ac.uk

## Field Summary

Fields inherited from class [edu.cu.gi.dmm.she.attribute.Attribute](#)

[NULL ATTRIBUTE VALUE](#)

## Constructor Summary

[LinearAttribute](#)(double[] values)

Constructor called when only the values (as an array of doubles) associated with this attribute are known

[LinearAttribute](#)(double[] values, double mean, double min, double max, double range, double sDev, double[] quartiles, double iqRange)

Constructor called when setting all values manually \* @param values Array storing the values for this attribute

[LinearAttribute](#)(int nValues, double[] values, double min, double max, double mean, double range, double sDev, double[] quartiles, double iqRange)

Constructor called when all the parameters associated with this attribute are known

[LinearAttribute](#)([LinearAttribute](#) linAtt)

Constructor called when initialising class using another attribute object

## Method Summary

double	<a href="#">getIqRange</a> () Returns the interquartile range (q3-q1) for this attribute
double	<a href="#">getMax</a> () Returns the max value of this attribute
double	<a href="#">getMean</a> () Returns the mean value of this attribute
double	<a href="#">getMin</a> () Returns the min value of this attribute

double[]	<a href="#">getQuartiles()</a> Returns the quartiles (q0 min, q1, q2 median, q3, q4 max) for this attribute
double	<a href="#">getRange()</a> Returns the range in getValues() of this attribute
double	<a href="#">getSDev()</a> Returns the standard deviation in getValues() of this attribute
void	<a href="#">setSDev(double sDev)</a> Sets the standard deviation of this attribute
java.lang.String	<a href="#">toString()</a> Returns a string representation of this class

**Methods inherited from class edu.cu.gi.dmm.she.attribute.[Attribute](#)**

[getTotNoValues](#), [getTotValidValues](#), [getValue](#), [getValues](#)

**Methods inherited from class java.lang.Object**

[equals](#), [getClass](#), [hashCode](#), [notify](#), [notifyAll](#), [wait](#), [wait](#), [wait](#)

## edu.cu.gi.dmm.she.attribute Class CircularAttribute

java.lang.Object

↳ [edu.cu.gi.dmm.she.attribute.Attribute](#)

↳ [edu.cu.gi.dmm.she.attribute.CircularAttribute](#)

---

```
public class CircularAttribute
extends Attribute
```

Stores the values for a 'circular' attribute (as a double array) and associated metadata. Should be used for circular attributes (as opposed to linear attributes), where values are measured on an cyclical scale from (for example) 0-360 degrees. See Brunson 2003, GISRUk proceedings and Cox 2003 for more on the calculation of circular statistics

**Version:** 0.1, 22 Oct 2003

**Author:** David Mountain, City Uni London, dmm@soi.city.ac.uk

### Field Summary

Fields inherited from class [edu.cu.gi.dmm.she.attribute.Attribute](#)

[NULL ATTRIBUTE VALUE](#)

### Constructor Summary

[CircularAttribute](#)([CircularAttribute](#) circAtt)

Constructor called when initialising class using another attribute object

[CircularAttribute](#)(double[] values, double lowerLimit, double upperLimit)

Constructor called when only the values (as an array of doubles) associated with this attribute are known

[CircularAttribute](#)(double[] values, double mean, double spread, double lowerLimit, double upperLimit)

Constructor called when all the parameters associated with this attribute are known

### Method Summary

double	<a href="#">getLowerLimit</a> ()
double	<a href="#">getMean</a> () Returns the mean value of this attribute
double	<a href="#">getSpread</a> () Returns the spread value of this circular attribute (a measure of distribution)
double	<a href="#">getUpperLimit</a> ()
void	<a href="#">setSpread</a> (double spread) Sets the spread value of this attribute
java.lang.String	<a href="#">toString</a> ()

	Returns a string representation of this class
--	---

<b>Methods inherited from class <code>edu.cu.gi.dmm.she.attribute.Attribute</code></b>
--

<code><a href="#">getTotNoValues</a></code> , <code><a href="#">getTotValidValues</a></code> , <code><a href="#">getValue</a></code> , <code><a href="#">getValues</a></code>
---

<b>Methods inherited from class <code>java.lang.Object</code></b>
---

<code><a href="#">equals</a></code> , <code><a href="#">getClass</a></code> , <code><a href="#">hashCode</a></code> , <code><a href="#">notify</a></code> , <code><a href="#">notifyAll</a></code> , <code><a href="#">wait</a></code> , <code><a href="#">wait</a></code> , <code><a href="#">wait</a></code>
--

## Package edu.cu.gi.dmm.she.grids

The grids package is used for field (raster) based representation. Among other classes in this package is the PredictionGrid class, which is used in for the storage of speed-heading prediction surfaces. The Grid and DoubleGrid classes, which the PredictionGrid class extends, are both also shown. Various other grid classes, including GridFactory which is used to created these raster surfaces, are not shown but can be made available upon request.

### Class Summary

<a href="#"><u>CircularAttributeGrid</u></a>	Storage class for a 2 dimensional grid coverage that extends Grid and stores a grid of CircularAttributes.
<a href="#"><u>DoubleGrid</u></a>	Storage class for a 2 dimensional grid coverage that extends Grid and stores a grid of values to double precision
<a href="#"><u>Grid</u></a>	Stores the spatial dimensions (aka domain) of a (2D) grid coverage; objects of this grid store no cell values but contain the methods for translating between column/row values to the native referencing system.
<a href="#"><u>GridFactory</u></a>	Class for creating different types of surfaces such as point density surfaces, speed surfaces etc...
<a href="#"><u>LinearAttributeGrid</u></a>	Storage class for a 2 dimensional grid coverage that extends Grid and stores a grid of LinearAttributes.
<a href="#"><u>PredictionGrid</u></a>	Stores prediction grid of all locations a moving object is likely to be given an origin and period of time into the future.

edu.cu.gi.dmm.she.grids

## Class Grid

java.lang.Object

└─ edu.cu.gi.dmm.she.grids.Grid

### Direct Known Subclasses:

[CircularAttributeGrid](#), [DoubleGrid](#), [LinearAttributeGrid](#)

```
public class Grid
extends java.lang.Object
```

Stores the spatial dimensions (aka domain) of a (2D) grid coverage; objects of this grid store no cell values but contain the methods for translating between column/row values to the native referencing system. It must be aligned according to some unrectified, 2 dimensional, numeric, linear coordinate schema (eg WGS84, decimal degrees, CH1903+).

Implementing classes store a grid of values (aka range set) where values can be numeric (such as double or int) or other objects (such as color).

The grid below shows the row column indexing for a 5\*5 grid ([column,row] or [x,y]).

52.6	[0,4]	[1,4]	[2,4]	[3,4]	[4,4]
52.5	[0,3]	[1,3]	[2,3]	[3,3]	[4,3]
52.4	[0,2]	[1,2]	[2,2]	[3,2]	[4,2]
22.3	[0,1]	[1,1]	[2,1]	[3,1]	[4,1]
52.2	[0,0]	[1,0]	[2,0]	[3,0]	[4,0]
	0.6	0.7	0.8	0.9	1.0

It follows the Euclidean 2D map coordinates format as opposed to the table/spreadsheet convention.

**Version:** 5.2, 16 June 2004

**Author:** David Mountain; City Uni, London; dmm@soi.city.ac.uk

### See Also:

[GridCreation](#)

## Field Summary

static double	<a href="#">OUT OF BOUNDS</a> Indicates that a row/column combination, or an x/y ref, fall outside the grid bounds
---------------	---

## Constructor Summary

[Grid](#)(com.vividsolutions.jts.geom.Envelope boundsIn, int nColsIn, int nRowsIn, java.lang.String srs)  
Creates new Grid by setting class variables

[Grid](#)([Grid](#) gridIn)  
Creates new Grid from an existing grid

## Method Summary

com.vividsolutions.jts.geom.Envelope	<a href="#">getBounds</a> ()
--------------------------------------	------------------------------

double	<a href="#"><u>getCellRes()</u></a>
int	<a href="#"><u>getCol()</u></a> (double xIn) Converts an x axis into a column value; returns the column that this x axis value falls into).
int	<a href="#"><u>getNCols()</u></a>
int	<a href="#"><u>getNRows()</u></a>
int	<a href="#"><u>getRow()</u></a> (double yIn)
java.lang.String	<a href="#"><u>getSrs()</u></a>
double	<a href="#"><u>getX()</u></a> (int colIn) Converts the column value (colIn) into an x axis value such (returns the value for the centre of the column).
double	<a href="#"><u>getY()</u></a> (int rowIn) Converts the row value (rowIn) into a y axis value (returns the value for the centre of the row).
boolean	<a href="#"><u>outOfBounds()</u></a> (int colIn, int rowIn) True if row/col number is out of grid bounds
java.lang.String	<a href="#"><u>toEsriHeaderString()</u></a> Returns a string representation of this grid's spatial metadata in ESRI Grid format

**Methods inherited from class java.lang.Object**

equals, getClass, hashCode, notify, notifyAll, toString, wait, wait, wait

**edu.cu.gi.dmm.she.grids**  
**Class DoubleGrid**

java.lang.Object

↳ [edu.cu.gi.dmm.she.grids.Grid](#)

↳ [edu.cu.gi.dmm.she.grids.DoubleGrid](#)

**Direct Known Subclasses:**

[PredictionGrid](#)

```
public class DoubleGrid
extends Grid
```

Storage class for a 2 dimensional grid coverage that extends Grid and stores a grid of values to double precision

**Version:** 2.1, 17 Nov 2003

**Author:** David Mountain; City Uni, London; dmm@soi.city.ac.uk

## Field Summary

<a href="#">LinearAttribute</a>	<a href="#">attribute</a> Stores the actual grid values of this grid coverage as an attribute
double[][]	<a href="#">cellValues</a> Stores the actual grid values of this grid coverage as doubles in a 2d array

### Fields inherited from class [edu.cu.gi.dmm.she.grids.Grid](#)

[OUT\\_OF\\_BOUNDS](#)

## Constructor Summary

[DoubleGrid](#)([Grid](#) gridDimensionsIn, double[][] cellValuesIn)  
 Creates new DoubleGrid by setting class variables

## Method Summary

double	<a href="#">getCellValue</a> (int colIn, int rowIn) Returns the attribute value of the specified cell (OUT_OF_BOUNDS, -999, if the cell/column combination exceeds the grid dimensions) Do not confuse this method with <a href="#">getCellValue(double x, double y)</a> , which uses real world coordinates as input parameters
double	<a href="#">getCellValue</a> (java.awt.geom.Point2D.Double xyIn) Returns the attribute value of the cell that corresponds to the specified x,y location (OUT_OF_BOUNDS, -999, if the cell/column combination exceeds the grid dimensions)
<a href="#">Grid</a>	<a href="#">getGrid</a> () Returns the superclass for this DoubleGrid
java.lang.String	<a href="#">toEsriString</a> () Returns an ESRI Grid string representation of this clas

### Methods inherited from class [edu.cu.gi.dmm.she.grids.Grid](#)

[getBounds](#), [getCellRes](#), [getCol](#), [getNCols](#), [getNRows](#), [getRow](#), [getSrs](#),  
[getX](#), [getY](#), [outOfBounds](#), [toEsriHeaderString](#)

**Methods inherited from class java.lang.Object**

[equals](#), [getClass](#), [hashCode](#), [notify](#), [notifyAll](#), [toString](#), [wait](#), [wait](#),  
[wait](#)

## edu.cu.gi.dmm.she.grids Class PredictionGrid

java.lang.Object

↳ [edu.cu.gi.dmm.she.grids.Grid](#)  
    ↳ [edu.cu.gi.dmm.she.grids.DoubleGrid](#)  
        ↳ [edu.cu.gi.dmm.she.grids.PredictionGrid](#)

### All Implemented Interfaces:

[Prediction](#)

### Direct Known Subclasses:

[AccessibilityGrid](#), [CrwaPredictionGrid](#)

```
public class PredictionGrid
extends DoubleGrid
implements Prediction
```

Stores prediction grid of all locations a moving object is likely to be given an origin and period of time into the future. This class implements prediction, so may predict for an instant of time in the future, or over an interval of time.

**Version:** v2.5, 22 June 2004

**Author:** David Mountain; City Uni, London; dmm@soi.city.ac.uk

**See Also:** [edu.cu.gi.dmm.she.cwa.CwaPredictionGrid](#),  
[edu.cu.gi.dmm.she.timeGeog.AccessibilityGrid](#)

## Field Summary

### Fields inherited from class [edu.cu.gi.dmm.she.grids.DoubleGrid](#)

[attribute](#), [cellValues](#)

### Fields inherited from class [edu.cu.gi.dmm.she.grids.Grid](#)

[OUT OF BOUNDS](#)

## Constructor Summary

[PredictionGrid](#)([Grid](#) gridDimensionsIn, double[][] cellValuesIn, java.awt.geom.Point2D.Double startLoc, java.util.Date startTime, long predictionLength, boolean destinationKnown, java.awt.geom.Point2D.Double actualDestination)  
Creates new PredictionGrid by setting class variables.

[PredictionGrid](#)([Grid](#) gridDimensionsIn, double[][] cellValuesIn, java.awt.geom.Point2D.Double startLoc, java.util.Date startTime, long predictionLength, boolean destinationKnown, java.awt.geom.Point2D.Double[] actualDestinations)  
Creates new PredictionGrid by setting class variables.

[PredictionGrid](#)([Grid](#) gridDimensionsIn, double[][] cellValuesIn, java.awt.geom.Point2D.Double startLoc, java.util.Date startTime, long predictionLength, int instantInterval)  
Creates new PredictionGrid by setting class variables.

## Method Summary

Java.awt.geom.Point2D.Double	<a href="#">getActualDestination</a> () Returns the verification point, at an instant in time (if known, else null)
java.awt.geom.Point2D.Double []	<a href="#">getActualDestinations</a> () Returns the verification points, for an interval of time (if known, else null)
boolean	<a href="#">getDestinationKnown</a> () whether the actual destination is known for this prediction
int	<a href="#">getInstantInterval</a> () Whether the prediction represents where the moving point object is likely to be at an instant in the future (eg exactly 15 minutes from now) or from now until that point in the future, over a temporal interval (from 0-15 minutes from now)
long	<a href="#">getPredictionDuration</a> () The period of time that defines the duration for any prediction
java.awt.geom.Point2D.Double	<a href="#">getStartLocation</a> () The spatial location defining the "starting point" for any prediction; it need not be contained within the grid
java.util.Date	<a href="#">getStartTime</a> () The time at the start of the prediction.
double	<a href="#">getSuccessRate</a> () returns the success rate for this grid (n verification points inside of the grid)
double	<a href="#">getVerificationValue</a> () Returns the verification value.

#### Methods inherited from class edu.cu.gi.dmm.she.grids.DoubleGrid

[getCellValue](#), [getCellValue](#), [getGrid](#), [toEsriString](#)

#### Methods inherited from class edu.cu.gi.dmm.she.grids.Grid

[getBounds](#), [getCellRes](#), [getCol](#), [getNCols](#), [getNRows](#), [getRow](#), [getSrs](#), [getX](#), [getY](#), [outOfBounds](#), [toEsriHeaderString](#)

#### Methods inherited from class java.lang.Object

[equals](#), [getClass](#), [hashCode](#), [notify](#), [notifyAll](#), [toString](#), [wait](#), [wait](#), [wait](#)

## Package edu.cu.gi.dmm.she.prediction

The prediction package has interfaces for predictions, and classes to store predictions based upon potential path areas (PpaPrediction) and spatial proximity (SpatialBufferPrediction). These type of predictions are described and evaluated extensively in the thesis.

### Interface Summary

<a href="#"><u>Prediction</u></a>	Interface for any form of prediction This can include point predictions or predictions grids.
-----------------------------------	---

### Class Summary

<a href="#"><u>InstantInterval</u></a>	Keys that record whether a prediction is predicting the future situation at an instant in time, or over an interval of time, in the future.
<a href="#"><u>PpaPrediction</u></a>	Makes a prediction about future behaviour based upon long-term previous experience
<a href="#"><u>SpatialBufferPrediction</u></a>	Stores a spatial proximity prediction

edu.cu.gi.dmm.she.prediction  
**Interface Prediction**

**All Known Implementing Classes:**

[AccessibilityGrid](#), [CrwaPrediction](#), [CrwaPredictionGrid](#),  
[CrwaRandomMultiStepPrediction](#), [CrwaRandomPrediction](#), [PpaPrediction](#),  
[PredictionGrid](#), [SpatialBufferPrediction](#)

---

```
public interface Prediction
```

Interface for any form of prediction This can include point predictions or predictions grids.

**version** 0.1, 6 May 2004

**author** David Mountain, City Uni London, dmm@soi.city.ac.uk

---

## Method Summary

java.awt.geom.Point2D.Double	<a href="#">getActualDestination()</a> Returns the actual destination (if known, else null)
java.awt.geom.Point2D.Double[]	<a href="#">getActualDestinations()</a> Returns the actual destination (if known, else null)
boolean	<a href="#">getDestinationKnown()</a> Returns whether the actual destination is known for this prediction
int	<a href="#">getInstantInterval()</a> Whether the prediction surface represents where the subject is likely to be at an instant in the future (eg exactly 15 minutes from now - false) or from now until that point in the future, over a temporal interval (from 0-15 minutes from now - true)
long	<a href="#">getPredictionDuration()</a> Returns the period of time (in millisecs), from <code>_startTime</code> for which the prediction is made, the duration of the prediction
java.awt.geom.Point2D.Double	<a href="#">getStartLocation()</a> Returns the starting location for the prediction in native coords
java.util.Date	<a href="#">getStartTime()</a> Returns the starting time for the prediction

## edu.cu.gi.dmm.she.prediction Class PpaPrediction

java.lang.Object

└ [edu.cu.gi.dmm.she.timeGeog.PotentialPathArea](#)

└ edu.cu.gi.dmm.she.prediction.PpaPrediction

### All Implemented Interfaces:

[Prediction](#)

```
public class PpaPrediction
extends PotentialPathArea
implements Prediction
```

Makes a prediction about future behaviour based upon long-term previous experience

**Version:** V0.1, 06 June 2005

**Author:** David Mountain; City Uni, London; dmm@soi.city.ac.uk

## Field Summary

### Fields inherited from class edu.cu.gi.dmm.she.timeGeog.[PotentialPathArea](#)

[timeBudget](#), [boundaryType](#), [hullPoints](#), [paths](#), [stPathBuffers](#),  
[targetPoint](#)

## Constructor Summary

[PpaPrediction](#)([PotentialPathArea](#) ppa, java.util.Date originTime,  
long predDurationMsecs)  
Creates new PpaPrediction

[PpaPrediction](#)([PotentialPathArea](#) ppa, java.util.Date originTime,  
java.awt.geom.Point2D.Double actualDestination,  
long predDurationMsecs)  
Creates new PpaPrediction

## Method Summary

java.awt.geom.Point2D.Double	<a href="#">getActualDestination</a> () The actual destination point (eg future position) if known, else null
boolean	<a href="#">getActualDestinationInsideHull</a> () tf is the prediction inside the hull (false if not known)
java.awt.geom.Point2D.Double []	<a href="#">getActualDestinations</a> () returns null, since ppas only predict for an instant in the future at the moment
boolean	<a href="#">getDestinationKnown</a> () whether the destination point is known or not (must be true for this type)
int	<a href="#">getInstantInterval</a> () Whether the prediction represents where the moving point object is likely to be at an

	instant in the future (eg exactly 15 minutes from now) or from now until that point in the future, over a temporal interval (from 0-15 minutes from now) @see InstantInterval
long	<a href="#">getPredictionDuration()</a> Returns the point in time (in millisecs) ahead of 'now' (ie in the future) for which the prediction should be made
double	<a href="#">getPredictionEffectiveness()</a> A measure of how effective this prediction is, based upon whether the point is in or out of the radius (1 or 0), and the root of surface area
java.awt.geom.Point2D.Double	<a href="#">getStartLocation()</a> Returns the point of origin (eg present position) in lat/lon
java.util.Date	<a href="#">getStartTime()</a> Returns the time at the start of the prediction
long	<a href="#">getTimeBudget()</a> Returns the time budget, the period of time used to follow each space time path, to define the accessible region

**Methods inherited from class edu.cu.gi.dmm.she.timeGeog.PotentialPathArea**

[getSurfaceArea](#), [toEsriGenerateString](#)

**Methods inherited from class java.lang.Object**

[equals](#), [getClass](#), [hashCode](#), [notify](#), [notifyAll](#), [toString](#), [wait](#), [wait](#), [wait](#)

**edu.cu.gi.dmm.she.prediction**  
**Class SpatialBufferPrediction**

java.lang.Object

↳ edu.cu.gi.dmm.she.prediction.SpatialBufferPrediction

**All Implemented Interfaces:**

[Prediction](#)

```
public class SpatialBufferPrediction
extends java.lang.Object
implements Prediction
```

Stores a spatial proximity prediction

**Version:** 0.1, 25 May 2005

**Author:** David Mountain, City Uni London, dmm@soi.city.ac.uk

## Constructor Summary

[SpatialBufferPrediction](#)(java.awt.geom.Point2D.Double origin, java.util.Date originTime, long predMsecs, double bufferSize)  
 Constructor; sets the class variables for an incoming data set.

[SpatialBufferPrediction](#)(java.awt.geom.Point2D.Double origin, java.util.Date originTime, long predMsecs, double bufferSize, java.awt.geom.Point2D.Double actualDestination)  
 Constructor; sets the class variables for an incoming data set.

## Method Summary

java.awt.geom.Point2D.Double	<a href="#">getActualDestination()</a> The actual destination point (eg future position) if known, else null
boolean	<a href="#">getActualDestinationInsideBuffer()</a> tf is the prediction inside the buffer (false if not known)
java.awt.geom.Point2D.Double[]	<a href="#">getActualDestinations()</a> returns null, since ppas only predict for an instant in the future at the moment
double	<a href="#">getBufferRadius()</a> The radius of the buffer around the spatial origin
boolean	<a href="#">getDestinationKnown()</a> whether the destination point is known or not (must be true for this type)
int	<a href="#">getInstantInterval()</a> Whether the prediction represents where the moving point object is likely to be at an instant in the future (eg exactly 15 minutes from now) or from now until that point in the future, over a temporal interval (from 0-15 minutes from now) @see InstantInterval
long	<a href="#">getPredictionDuration()</a> Returns the point in time (in millisecs) ahead of 'now' (ie in the future) for which the

	prediction should be made
double	<a href="#">getPredictionEffectiveness()</a> A measure of how effective this prediction is, based upon whether the point is in or out of the radius (1 or 0), and the root of surface area
java.awt.geom.Point2D.Double	<a href="#">getStartLocation()</a> Returns the point of origin (eg present position) in lat/lon
java.util.Date	<a href="#">getStartTime()</a> Returns the time at the start of the prediction

#### Methods inherited from class java.lang.Object

equals, getClass, hashCode, notify, notifyAll, toString, wait, wait, wait

## Package edu.cu.gi.dmm.she.prediction.cwa

These classes are used to store speed-heading predictions.

<b>Class Summary</b>	
<a href="#"><u>CrwaPrediction</u></a>	Takes an origin, speed, time and heading and calculates a destination. It is intended to predict a future position given a present position (origin), speed and heading calculated some way.
<a href="#"><u>CrwaPredictionGrid</u></a>	Stores prediction grid of all locations a moving object is likely to be given an origin and period of time into the future.
<a href="#"><u>CrwaRandomMultiStepPrediction</u></a>	Extends CwaRandomPrediction to be a series of short steps, rather than a single straight step.
<a href="#"><u>CrwaRandomPrediction</u></a>	Extends CwaPrediction to add random element to the prediction of future locations, based on the distribution of the speed and heading attributes.

edu.cu.gi.dmm.she.prediction.cwa

## Class CrwaPrediction

java.lang.Object

└─ edu.cu.gi.dmm.she.prediction.cwa.CrwaPrediction

All Implemented Interfaces:

[Prediction](#)

Direct Known Subclasses:

[CrwaRandomPrediction](#)

---

```
public class CrwaPrediction
extends java.lang.Object
implements Prediction
```

Takes an origin, speed, time and heading and calculates a destination It is intended to predict a future position given a present position (origin), speed and heading calculated some way

**Version:** 0.3, 12 May 2005

**Author:** David Mountain, City Uni London, dmm@soi.city.ac.uk

## Field Summary

boolean	<a href="#">determistic</a> Records whether this prediction is deterministic or probabilistic random
boolean	<a href="#">multistep</a> Records whether this prediction is a single or multistep
<a href="#">SpatialHistory</a>	<a href="#">recentBehaviour</a> The set of 'recent' points used to calculate the mean speed and heading, if the first constructor is used

## Constructor Summary

[CrwaPrediction](#)(java.awt.geom.Point2D.Double origin, java.util.Date originTime, long predMsecs, [SpatialHistory](#) recentBehaviour)

Constructor; sets the class variables for an incoming data set.

## Method Summary

void	<a href="#">calcPredictedDestination</a> () Sets the predicted destination point (eg future position) in lat/lon, l values.
java.awt.geom.Point2D.Double	<a href="#">getActualDestination</a> () Returns the actual destination (if known, else null)
java.awt.geom.Point2D.Double[]	<a href="#">getActualDestinations</a> () Returns the actual destination (if known, else null)
boolean	<a href="#">getDestinationKnown</a> () Returns whether the actual destination is known for this prediction
double	<a href="#">getHeadingMean</a> () Returns the heading calculated some way (eg the circular mean over 360 degrees)

double	<a href="#">getHeadingSpread()</a>
int	<a href="#">getInstantInterval()</a> returns whether this prediction is predicting for an instant in the future
java.awt.geom.Point2D.Double	<a href="#">getPredictedDestination()</a> The predicted destination point
long	<a href="#">getPredictionDuration()</a> Returns the point in time (in millisecs) ahead of 'now' (ie in t should be made
<a href="#">SpatialHistory</a>	<a href="#">getRecentHistory()</a> Returns the set of 'recent' points used to calculate the mean : constructor is used.
double	<a href="#">getSpeedMean()</a> Returns the speed used for the prediction
double	<a href="#">getSpeedSDev()</a>
java.awt.geom.Point2D.Double	<a href="#">getStartLocation()</a> Returns the point of origin (eg present position) in lat/lon
java.util.Date	<a href="#">getStartTime()</a> Returns the time at the start of the predcition
void	<a href="#">setHeading</a> (double headingMean, double headingSpr Sets the heading used for the prediction
void	<a href="#">setPredictedDestination</a> (java.awt.geom.Point2D.Do Sets the predicted destination point
void	<a href="#">setSpeed</a> (double speedMean, double speedSDev) Sets the speed attribute object

#### Methods inherited from class java.lang.Object

equals, getClass, hashCode, notify, notifyAll, toString, wait, wait, wait

## edu.cu.gi.dmm.she.prediction.cwa Class CrwaPredictionGrid

java.lang.Object

↳ [edu.cu.gi.dmm.she.grids.Grid](#)

↳ [edu.cu.gi.dmm.she.grids.DoubleGrid](#)

↳ [edu.cu.gi.dmm.she.grids.PredictionGrid](#)

↳ [edu.cu.gi.dmm.she.prediction.cwa.CrwaPredictionGrid](#)

### All Implemented Interfaces:

[Prediction](#)

```
public class CrwaPredictionGrid  
extends PredictionGrid
```

Stores prediction grid of all locations a moving object is likely to be given an origin and period of time into the future. This format stores all values associated with a Correlated Walk Analysis Monte Carlo Prediction.

### Version:

2.2, 14 Nov 2003

### Author:

David Mountain; City Uni, London; dmm@soi.city.ac.uk

## Field Summary

### Fields inherited from class [edu.cu.gi.dmm.she.grids.DoubleGrid](#)

[attribute](#), [\\_cellValues](#)

### Fields inherited from class [edu.cu.gi.dmm.she.grids.Grid](#)

[OUT OF BOUNDS](#)

## Constructor Summary

```
CrwaPredictionGrid(Grid gridDimensionsIn, double[][] cellValuesIn,  
java.awt.geom.Point2D.Double origin, java.util.Date originTime,  
long millisInFuture, SpatialHistory recentBehaviour,  
long recentBehaviourDuration, boolean destinationKnown,  
java.awt.geom.Point2D.Double actualDestination)
```

Creates new PredictionGrid by setting class variables Used for an instantaneous prediction, when there is just one verification point

```
CrwaPredictionGrid(Grid gridDimensionsIn, double[][] cellValuesIn,  
java.awt.geom.Point2D.Double origin, java.util.Date originTime,  
long millisInFuture, SpatialHistory recentBehaviour,  
long recentBehaviourDuration, boolean destinationKnown,  
java.awt.geom.Point2D.Double[] actualDestinations)
```

Creates new PredictionGrid by setting class variables

## Method Summary

[SpatialHistory](#) [getRecentBehaviour](#)()

Returns the points and attributes defining 'recent behaviour' that is used for the predicting future locations'

long [getRecentBehaviourDuration\(\)](#)

Returns the period of time into the past for which defines 'recent behaviour', from the first point in the 'recent behaviour' set, to the origin time, in millisecs

**Methods inherited from class edu.cu.gi.dmm.she.grids.[PredictionGrid](#)**

[getActualDestination](#), [getActualDestinations](#), [getDestinationKnown](#), [getInstantInterval](#), [getPredictionDuration](#), [getStartLocation](#), [getStartTime](#), [getSuccessRate](#), [getVerificationValue](#)

**Methods inherited from class edu.cu.gi.dmm.she.grids.[DoubleGrid](#)**

[getCellValue](#), [getCellValue](#), [getGrid](#), [toEsriString](#)

**Methods inherited from class edu.cu.gi.dmm.she.grids.[Grid](#)**

[getBounds](#), [getCellRes](#), [getCol](#), [getNCols](#), [getNRows](#), [getRow](#), [getSrs](#), [getX](#), [getY](#), [outOfBounds](#), [toEsriHeaderString](#)

**Methods inherited from class java.lang.Object**

[equals](#), [getClass](#), [hashCode](#), [notify](#), [notifyAll](#), [toString](#), [wait](#), [wait](#), [wait](#)

**edu.cu.gi.dmm.she.prediction.cwa**  
**Class CrwaRandomMultiStepPrediction**

java.lang.Object

↳ [edu.cu.gi.dmm.she.prediction.cwa.CrwaPrediction](#)

↳ [edu.cu.gi.dmm.she.prediction.cwa.CrwaRandomPrediction](#)

↳

edu.cu.gi.dmm.she.prediction.cwa.CrwaRandomMultiStepPrediction

**All Implemented Interfaces:**

[Prediction](#)

---

```
public class CrwaRandomMultiStepPrediction
extends CrwaRandomPrediction
```

Extends CrwaRandomPrediction to be a series of short steps, rather than a single straight step.

**Version:** 0.3, 12 May 2005

**Author:** David Mountain, City Uni London, dmm@soi.city.ac.uk

## Field Summary

Fields inherited from class [edu.cu.gi.dmm.she.prediction.cwa.CrwaPrediction](#)

[\\_deterministic](#), [\\_multistep](#), [\\_recentBehaviour](#)

## Constructor Summary

[CrwaRandomMultiStepPrediction](#)(java.awt.geom.Point2D.Double origin, java.util.Date originTime, long predMsecs, [SpatialHistory](#) recentBehaviour)

Calls super class to get deterministic values, then resets mean and heading with a random element and recalculates the prediction

## Method Summary

void	<a href="#">calcPredictedPath</a> (double meanSpeed, double sdevSpeed, double meanHeading, double sdevHeading) Calculates the predicted path.
java.util.List	<a href="#">getStepPoints</a> ()

Methods inherited from class [edu.cu.gi.dmm.she.prediction.cwa.CrwaRandomPrediction](#)

[randomizeHeading](#), [randomizeSpeed](#)

Methods inherited from class [edu.cu.gi.dmm.she.prediction.cwa.CrwaPrediction](#)

[calcPredictedDestination](#), [getActualDestination](#), [getActualDestinations](#), [getDestinationKnown](#), [getHeadingMean](#), [getHeadingSpread](#), [getInstantInterval](#), [getPredictedDestination](#), [getPredictionDuration](#), [getRecentHistory](#), [getSpeedMean](#), [getSpeedSDev](#),

[getStartLocation](#), [getStartTime](#), [setHeading](#), [setPredictedDestination](#),  
[setSpeed](#)

**Methods inherited from class java.lang.Object**

[equals](#), [getClass](#), [hashCode](#), [notify](#), [notifyAll](#), [toString](#), [wait](#), [wait](#),  
[wait](#)

## edu.cu.gi.dmm.she.prediction.cwa Class CrwaRandomPrediction

java.lang.Object

↳ [edu.cu.gi.dmm.she.prediction.cwa.CrwaPrediction](#)

↳ [edu.cu.gi.dmm.she.prediction.cwa.CrwaRandomPrediction](#)

### All Implemented Interfaces:

[Prediction](#)

### Direct Known Subclasses:

[CrwaRandomMultiStepPrediction](#)

```
public class CrwaRandomPrediction
extends CrwaPrediction
```

Extends CwaPrediction to add a random element to the prediction of future locations, based on the distribution of the speed and heading attributes. Whereas CwaPrediction will always return the same prediction for a given set of points (eg based upon the mean speed and heading of those points), CrwaRandomPrediction will vary the result according to the distribution of the speed and heading.

**Version:** 0.3, 11 May 2005

**Author:** David Mountain, City Uni London, dmm@soi.city.ac.uk

## Field Summary

Fields inherited from class [edu.cu.gi.dmm.she.prediction.cwa.CrwaPrediction](#)

[determistic](#), [\\_multistep](#), [\\_recentBehaviour](#)

## Constructor Summary

[CrwaRandomPrediction](#)(java.awt.geom.Point2D.Double origin, java.util.Date originTime, long predMsecs, [SpatialHistory](#) recentBehaviour)

Constructor; sets the class variables for an incoming data set.

## Method Summary

void [randomizeHeading](#)(double mean, double spread)  
Resets heading to a value taken from the cumulative probability function

void [randomizeSpeed](#)(double mean, double stDev)  
Resets speed to a value taken from the cumulative probability function

Methods inherited from class  
[edu.cu.gi.dmm.she.prediction.cwa.CrwaPrediction](#)

[calcPredictedDestination](#), [getActualDestination](#),  
[getActualDestinations](#), [getDestinationKnown](#), [getHeadingMean](#),  
[getHeadingSpread](#), [getInstantInterval](#), [getPredictedDestination](#),  
[getPredictionDuration](#), [getRecentHistory](#), [getSpeedMean](#), [getSpeedSDev](#),  
[getStartLocation](#), [getStartTime](#), [setHeading](#), [setPredictedDestination](#),  
[setSpeed](#)

## Package edu.cu.gi.dmm.she.timeGeog

The time geography classes are used for modeling individual accessibility, and are based upon the ideas of the time geography school. These include the space-time path, potential path area and isochrone surfaces, all discussed extensively in the body of the thesis.

### Interface Summary

<a href="#"><u>Isochrone</u></a>	Interface for an Isochrone.
----------------------------------	-----------------------------

### Class Summary

<a href="#"><u>AccessibilityGrid</u></a>	Calculates a surface of values that representing accessiblity from some target location.
<a href="#"><u>IsochroneSurface</u></a>	Stores the values associated with a IsochroneSurface.
<a href="#"><u>PotentialPathArea</u></a>	Stores the values associated with a potential path area (calculated elsewhere @see TimeGeogCreation)
<a href="#"><u>PpaBoundaryType</u></a>	Stores the possible boundary types for a ppa buffer, hull, etc.
<a href="#"><u>SpaceTimePath</u></a>	Stores a space time path..
<a href="#"><u>TimeGeogFactory</u></a>	Utility class for creating Time Geog objects

**edu.cu.gi.dmm.she.timeGeog**  
**Class SpaceTimePath**

java.lang.Object

↳ [edu.cu.gi.dmm.she.sets.PointSet](#)

↳ [edu.cu.gi.dmm.she.timeGeog.SpaceTimePath](#)

**All Implemented Interfaces:**

java.lang.Iterable, java.util.Collection, java.util.Set

---

```
public class SpaceTimePath
extends PointSet
```

Stores a space time path - a series of points representing a section of a mobile trajectory defined by an individual moving through space-time. Extends PointSet.... (calculated elsewhere @see TimeGeogCreation)

**Author:** David Mountain; City Uni, London; dmm@soi.city.ac.uk

## Field Summary

java.util.Date	<a href="#">startTime</a> The target location for the trace
java.awt.geom.Point2D.Double	<a href="#">target</a> The target location for the path
java.util.List	<a href="#">timeStamps</a> List of timestamps that correspond to the pointID 2D spatial locations
<b>Fields inherited from class <a href="#">edu.cu.gi.dmm.she.sets.PointSet</a></b>	
<a href="#">centroid</a> , <a href="#">nPoints</a> , <a href="#">pointList</a>	

## Constructor Summary

[SpaceTimePath](#)(java.util.List pointsParam,  
[SpatialHistory](#) parentHist,  
java.awt.geom.Point2D.Double targetParam)  
Creates new path from a set of PointIDs, timestamps and a target location

## Method Summary

java.lang.String	<a href="#">toLongString</a> () Returns a full string representation of this class
java.lang.String	<a href="#">toString</a> () Returns a summary string representation of this class

**Methods inherited from class [edu.cu.gi.dmm.she.sets.PointSet](#)**

[add](#), [addAll](#), [clear](#), [contains](#), [containsAll](#), [get](#), [isEmpty](#), [iterator](#), [remove](#), [removeAll](#), [retainAll](#), [size](#), [toArray](#), [toArray](#), [toStringLong](#)

**Methods inherited from interface [java.util.Set](#)**

[equals](#), [hashCode](#)

**edu.cu.gi.dmm.she.timeGeog**  
**Class PotentialPathArea**

java.lang.Object

└ edu.cu.gi.dmm.she.timeGeog.PotentialPathArea

**Direct Known Subclasses:**

[PpaPrediction](#)

```
public class PotentialPathArea
extends java.lang.Object
```

Stores the values associated with a potential path area (calculated elsewhere @see TimeGeogCreation)

**Version:** V1.1, 01 June 2004

**Author:** David Mountain; City Uni, London; dmm@soi.city.ac.uk

<b>Field Summary</b>	
long	<a href="#">timeBudget</a> The time budget to be used when calculating this potential path area.
int	<a href="#">boundaryType</a> Stores whether the boundary type used for this potential path area.
java.awt.geom.Point2D.Double[]	<a href="#">hullPoints</a> The array of points that defines the bounding convex hull, that can be used to represent the region of space accessible given a time budget of timeCutoff, for this ppa This object is only initialized if the boundaryType == PpaBoundaryType.CONVEX_HULL
java.util.List	<a href="#">paths</a> The list of space time paths that defines this ppa
com.vividsolutions.jts.geom.Geometry[]	<a href="#">stPathBuffers</a> An array of polygons that defines the buffers, around each space time path, that can be used to represent the region of space accessible given a time budget of timeCutoff, for this ppa.
java.awt.geom.Point2D.Double	<a href="#">targetPoint</a> The target spatial location (2D) that is the starting position for this ppa

<b>Constructor Summary</b>
<a href="#">PotentialPathArea</a> (java.util.List paths, com.vividsolutions.jts.geom.Geometry[] stPathBuffers, java.awt.geom.Point2D.Double targetPoint, long timeBudget) Creates new PotentialPathArea.
<a href="#">PotentialPathArea</a> (java.util.List paths,

```
java.awt.geom.Point2D.Double[] polyPoints,  
java.awt.geom.Point2D.Double targetPoint, long timeBudget)  
Creates new PotentialPathArea.
```

```
PotentialPathArea(PotentialPathArea ppa)  
Creates new PotentialPathArea from an existing Potential Path Area.
```

## Method Summary

double	<a href="#">getSurfaceArea</a> () the surface area of the hull
java.lang.String	<a href="#">toEsriGenerateString</a> () Exports the spatial boundary of this PotentialPathArea as an ESRI GENERATE string generate format is

### Methods inherited from class java.lang.Object

`equals`, `getClass`, `hashCode`, `notify`, `notifyAll`, `toString`, `wait`, `wait`, `wait`

**edu.cu.gi.dmm.she.timeGeog**  
**Class PpaBoundaryType**

java.lang.Object

└ edu.cu.gi.dmm.she.timeGeog.PpaBoundaryType

---

```
public class PpaBoundaryType
extends java.lang.Object
```

Stores the possible boundary types for a ppa buffer, hull, etc.

**Version:**

1.0, 22 Jun 2005

**Author:**

David Mountain; City Uni, London; dmm@soi.city.ac.uk

---

## Field Summary

static int	<a href="#">BUFFER</a> Indicates that the boundary types is a buffer hull
static int	<a href="#">CONVEX HULL</a> Indicates that the boundary types is a convex hull
static int	<a href="#">UNKNOWN_PARAMETER</a>

---

## Constructor Summary

[PpaBoundaryType](#) ()

---

## Method Summary

static int	<a href="#">getKeyFromLabel</a> (java.lang.String label) returns the string label associated with a boundary type
static java.lang.String	<a href="#">getLabelFromKey</a> (int key) returns the string label associated with a boundary type

---

### Methods inherited from class java.lang.Object

equals, getClass, hashCode, notify, notifyAll, toString, wait, wait, wait

**edu.cu.gi.dmm.she.timeGeog**  
**Interface Isochrone**

---

```
public interface IIsochrone
```

Interface for an Isochrone. Has polyline spatial geometry, a single temporal attribute and spatial origin location.

**Version:**

VO.1, 22 June 2004

**Author:**

David Mountain; City Uni, London; dmm@soi.city.ac.uk

---

## Method Summary

com.vividsolutions.jts.geom.LineString	<a href="#">getIsoline()</a>
com.vividsolutions.jts.geom.Point	<a href="#">getOrigin()</a>
long	<a href="#">getTimeBudget()</a>
java.lang.String	<a href="#">toEsriGenerateString()</a>
java.lang.String	<a href="#">toString()</a>

## edu.cu.gi.dmm.she.timeGeog Class IsochroneSurface

java.lang.Object

└ edu.cu.gi.dmm.she.timeGeog.IsochroneSurface

```
public class IsochroneSurface
extends java.lang.Object
```

Stores the values associated with a IsochroneSurface. This is a series of potential path areas for the same location, that form a graded surface of how long it takes to reach different points. Calculated elsewhere @see TimeGeogCreation

### Version:

V1.0, 10 Mar 2004

### Author:

David Mountain; City Uni, London; dmm@soi.city.ac.uk

## Field Summary

int	<a href="#">nPPAs</a> The number of potential path areas that form this IsochroneSurface
java.util.List	<a href="#">potentialPathAreas</a> The list of potential path areas that defines this IsochroneSurface
java.awt.geom.Point2D.Double	<a href="#">targetPoint</a> The target spatial location (2D) that is the starting position for this ppa

## Constructor Summary

```
IsochroneSurface(java.util.List ppas,  
java.awt.geom.Point2D.Double targetPointParam)  
Creates new IsochroneSurface
```

## Method Summary

### Methods inherited from class java.lang.Object

```
equals, getClass, hashCode, notify, notifyAll, toString, wait, wait,  
wait
```

## edu.cu.gi.dmm.she.timeGeog Class AccessibilityGrid

java.lang.Object

↳ [edu.cu.gi.dmm.she.grids.Grid](#)

↳ [edu.cu.gi.dmm.she.grids.DoubleGrid](#)

↳ [edu.cu.gi.dmm.she.grids.PredictionGrid](#)

↳ [edu.cu.gi.dmm.she.timeGeog.AccessibilityGrid](#)

### All Implemented Interfaces:

[Prediction](#)

```
public class AccessibilityGrid
extends PredictionGrid
```

Calculates a surface of values that representing accessibility from some target location. Each cell represents the time taken to travel from the startLocation. It is usually calculated by inductive analysis of previous behaviour. It can represent the fastest traversal, slowest traversal or mean of all traversals within the search kernel for each cell in the grid. It is a subclass of PredictionGrid and adds no new methods or fields.

**Version:** 0.2, 17 Feb 2004

## Field Summary

int	<a href="#">kernelSearchParameter</a> A parameter that controls what value to search for within the search kernel, and hence how "free" an agent is to move when constructing this surface.
static int	<a href="#">FASTEST</a> Indicates that each cell in this accessibility grid stores the fastest recorded travel time from the target to within the search buffer around each cell
static int	<a href="#">MEAN</a> Indicates that each cell in this accessibility grid stores the mean of all recorded travel times from the target to within the search buffer around each cell
static int	<a href="#">SLOWEST</a> Indicates that each cell in this accessibility grid stores the slowest recorded travel time from the target to within the search buffer around each cell

### Fields inherited from class edu.cu.gi.dmm.she.grids.[DoubleGrid](#)

[\\_attribute](#), [\\_cellValues](#)

### Fields inherited from class edu.cu.gi.dmm.she.grids.[Grid](#)

[OUT OF BOUNDS](#)

## Constructor Summary

```
AccessibilityGrid(Grid gridDimensionsIn, double[][] cellValuesIn,  
java.awt.geom.Point2D.Double spatialFocus,
```

```
java.util.Date startTime, long maxTravelTime,  
int kernelSearchParamIn)  
    Creates new AccessibilityGrid by setting class variables
```

## Method Summary

### Methods inherited from class edu.cu.gi.dmm.she.grids.[PredictionGrid](#)

[getActualDestination](#), [getActualDestinations](#), [getDestinationKnown](#),  
[getInstantInterval](#), [getPredictionDuration](#), [getStartLocation](#),  
[getStartTime](#), [getSuccessRate](#), [getVerificationValue](#)

### Methods inherited from class edu.cu.gi.dmm.she.grids.[DoubleGrid](#)

[getCellValue](#), [getCellValue](#), [getGrid](#), [toEsriString](#)

### Methods inherited from class edu.cu.gi.dmm.she.grids.[Grid](#)

[getBounds](#), [getCellRes](#), [getCol](#), [getNCols](#), [getNRows](#), [getRow](#), [getSrs](#),  
[getX](#), [getY](#), [outOfBounds](#), [toEsriHeaderString](#)

### Methods inherited from class java.lang.Object

[equals](#), [getClass](#), [hashCode](#), [notify](#), [notifyAll](#), [toString](#), [wait](#), [wait](#),  
[wait](#)

# **Appendix 3**

## **Results from prediction surface testing**

# A1 Walking scenario

## A1.1 Short-term prediction (walking, t+10min)

### A1.1.1 Speed-heading predictions

Table A1.1: Median verification value (vv) - Walking scenario, short-term prediction, speed-heading approach

'recent' period (mins)	5	15	30	60	180	360	720	1440
no decay	0.00	0.62	1.45	2.32	9.43	9.98	9.83	7.70
Linear	0.00	0.92	1.62	2.51	9.48	9.94	10.68	6.86
power (1.5)	0.00	0.21	1.06	1.79	6.16	9.05	9.18	10.76
power (2)	0.00	0.00	0.06	0.23	1.80	3.07	3.09	3.69
power (3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
mean	0.00	0.35	0.84	1.37	5.38	6.41	6.56	5.80

**Table A1.2: Median surface area (sa) - Walking scenario, short-term prediction, speed-heading approach**

<b>'recent' period (mins)</b>	<b>5</b>	<b>15</b>	<b>30</b>	<b>60</b>	<b>180</b>	<b>360</b>	<b>720</b>	<b>1440</b>
<b>no decay</b>	1.8E+05	6.7E+05	1.1E+06	1.6E+06	1.3E+08	2.4E+08	2.4E+08	8.9E+07
<b>linear</b>	1.0E+05	5.7E+05	9.4E+05	1.5E+06	3.1E+07	1.7E+08	1.7E+08	5.5E+07
<b>power (1.5)</b>	1.3E+05	3.3E+05	4.5E+05	7.2E+05	4.4E+06	1.3E+07	1.4E+07	2.0E+07
<b>power (2)</b>	9.0E+04	1.8E+05	2.2E+05	3.2E+05	9.5E+05	1.6E+06	1.6E+06	1.8E+06
<b>power (3)</b>	4.2E+04	6.0E+04	6.4E+04	6.7E+04	9.8E+04	9.3E+04	9.9E+04	9.7E+04
<b>mean</b>	1.1E+05	3.6E+05	5.5E+05	8.6E+05	3.3E+07	8.4E+07	8.6E+07	3.3E+07

**Table A1.3: Median prediction surface effectiveness (pse) - Walking scenario, short-term prediction, speed-heading approach**

<b>'recent' period (mins)</b>	<b>5</b>	<b>15</b>	<b>30</b>	<b>60</b>	<b>180</b>	<b>360</b>	<b>720</b>	<b>1440</b>
<b>no decay</b>	0.0E+00	8.4E-07	8.6E-07	9.2E-07	3.0E-08	4.5E-08	4.6E-08	8.3E-08
<b>linear</b>	0.0E+00	9.5E-07	1.2E-06	9.3E-07	5.0E-08	6.8E-08	7.0E-08	1.1E-07
<b>power (1.5)</b>	0.0E+00	3.8E-07	1.2E-06	1.1E-06	6.9E-07	5.8E-07	5.8E-07	4.8E-07
<b>power (2)</b>	0.0E+00	0.0E+00	1.7E-07	3.9E-07	1.0E-06	1.5E-06	1.4E-06	1.4E-06
<b>power (3)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
<b>mean</b>	0.0E+00	4.3E-07	6.8E-07	6.7E-07	3.6E-07	4.3E-07	4.1E-07	4.2E-07

**Table A1.4: Success rate (sr) - Walking scenario, short-term prediction, speed-heading approach**

<b>'recent' period (mins)</b>	<b>5</b>	<b>15</b>	<b>30</b>	<b>60</b>	<b>180</b>	<b>360</b>	<b>720</b>	<b>1440</b>
<b>no decay</b>	0.56	0.73	0.77	0.87	0.68	1.00	1.00	1.00
<b>linear</b>	0.45	0.72	0.81	0.86	0.67	1.00	1.00	0.98
<b>power (1.5)</b>	0.48	0.65	0.75	0.85	0.97	1.00	1.00	1.00
<b>power (2)</b>	0.36	0.53	0.61	0.65	0.81	0.92	0.92	0.93
<b>power (3)</b>	0.27	0.31	0.31	0.36	0.42	0.42	0.42	0.43
<b>mean</b>	0.43	0.59	0.65	0.72	0.71	0.87	0.87	0.87

### A1.1.2 Spatial proximity predictions

**Table A1.5: Median verification value (vv) - Walking scenario, short-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>100</b>	<b>250</b>	<b>500</b>	<b>750</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>3000</b>	<b>5000</b>	<b>7500</b>	<b>10000</b>
<b>no decay</b>	0.00	0.00	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38
<b>linear</b>	0.00	0.00	0.60	1.77	2.36	2.94	3.14	3.51	3.66	3.89	3.89
<b>power (1.5)</b>	0.00	0.00	0.50	0.93	1.45	2.71	3.64	7.82	12.16	40.66	40.66
<b>power (2)</b>	0.00	0.00	0.24	0.56	1.00	2.30	3.40	9.44	17.00	84.98	84.98
<b>power (3)</b>	0.00	0.00	0.03	0.10	0.23	0.80	1.44	6.66	16.08	179.81	179.81
<b>linear offset</b>	0.00	0.00	1.13	1.45	1.53	1.43	1.33	1.17	1.10	1.00	1.00
<b>mean</b>	0.00	0.00	0.65	1.03	1.32	1.93	2.39	5.00	8.56	51.95	51.95

**Table A1.6: Median surface area (sa) - Walking scenario, short-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>100</b>	<b>250</b>	<b>500</b>	<b>750</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>3000</b>	<b>5000</b>	<b>7500</b>	<b>10000</b>
<b>no decay</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>linear</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>power (1.5)</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>power (2)</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>power (3)</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>linear offset</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>mean</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08

**Table A1.7: Median prediction surface effectiveness (pse) - Walking scenario, short-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>100</b>	<b>250</b>	<b>500</b>	<b>750</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>3000</b>	<b>5000</b>	<b>7500</b>	<b>10000</b>
<b>no decay</b>	0.0E+00	0.0E+00	1.3E-06	5.8E-07	3.2E-07	1.4E-07	8.1E-08	3.6E-08	1.3E-08	5.8E-09	3.2E-09
<b>linear</b>	0.0E+00	0.0E+00	5.6E-07	7.4E-07	5.5E-07	3.1E-07	1.8E-07	9.2E-08	3.4E-08	1.6E-08	9.1E-09
<b>power (1.5)</b>	0.0E+00	0.0E+00	4.7E-07	3.9E-07	3.4E-07	2.8E-07	2.1E-07	2.0E-07	1.1E-07	1.7E-07	9.5E-08
<b>power (2)</b>	0.0E+00	0.0E+00	2.3E-07	2.3E-07	2.3E-07	2.4E-07	2.0E-07	2.5E-07	1.6E-07	3.5E-07	2.0E-07
<b>power (3)</b>	0.0E+00	0.0E+00	2.6E-08	4.0E-08	5.4E-08	8.3E-08	8.4E-08	1.7E-07	1.5E-07	7.5E-07	4.2E-07
<b>linear offset</b>	0.0E+00	0.0E+00	1.1E-06	6.1E-07	3.6E-07	1.5E-07	7.8E-08	3.0E-08	1.0E-08	4.2E-09	2.3E-09
<b>mean</b>	0.0E+00	0.0E+00	6.1E-07	4.3E-07	3.1E-07	2.0E-07	1.4E-07	1.3E-07	8.0E-08	2.2E-07	1.2E-07

**Table A1.8: Success rate (sr) - Walking scenario, short-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>100</b>	<b>250</b>	<b>500</b>	<b>750</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>3000</b>	<b>5000</b>	<b>7500</b>	<b>10000</b>
<b>no decay</b>	0.04	0.32	0.76	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<b>linear</b>	0.04	0.32	0.76	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<b>power (1.5)</b>	0.04	0.32	0.76	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<b>power (2)</b>	0.04	0.32	0.76	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<b>power (3)</b>	0.04	0.32	0.76	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<b>linear offset</b>	0.04	0.32	0.76	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<b>mean</b>	0.04	0.32	0.76	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

## A1.2 Long-term prediction (walking , t+60min)

### A1.2.1 Speed-heading predictions

Table A1.9: Median verification value (vv) - Walking scenario, long-term prediction, speed-heading approach

'recent' period (mins)	5	15	30	60	180	360	720	1440
<b>no decay</b>	0.00	0.00	0.47	1.47	9.26	10.27	10.00	8.46
<b>linear</b>	0.00	0.00	0.56	1.30	9.32	10.43	10.53	7.82
<b>power (1.5)</b>	0.00	0.00	0.00	0.58	5.02	8.60	8.95	10.12
<b>power (2)</b>	0.00	0.00	0.00	0.00	0.21	1.26	1.34	1.45
<b>power (3)</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>mean</b>	0.00	0.00	0.20	0.67	4.76	6.11	6.16	5.57

**Table A1.10: Median surface area (sa) - Walking scenario, long-term prediction, speed-heading approach**

<b>'recent' period (mins)</b>	<b>5</b>	<b>15</b>	<b>30</b>	<b>60</b>	<b>180</b>	<b>360</b>	<b>720</b>	<b>1440</b>
<b>no decay</b>	6.3E+06	2.6E+07	3.8E+07	5.9E+07	8.5E+09	9.3E+09	9.0E+09	3.8E+09
<b>linear</b>	4.1E+06	2.1E+07	3.3E+07	5.7E+07	2.9E+09	6.6E+09	6.6E+09	2.4E+09
<b>power (1.5)</b>	4.7E+06	1.2E+07	1.8E+07	2.9E+07	3.1E+08	5.4E+08	5.2E+08	7.5E+08
<b>power (2)</b>	3.5E+06	6.9E+06	8.7E+06	1.2E+07	4.6E+07	6.2E+07	6.2E+07	7.0E+07
<b>power (3)</b>	1.7E+06	2.6E+06	2.5E+06	2.7E+06	3.9E+06	3.7E+06	3.7E+06	4.0E+06
<b>mean</b>	4.0E+06	1.4E+07	2.0E+07	3.2E+07	2.3E+09	3.3E+09	3.2E+09	1.4E+09

**Table A1.11: Median prediction surface effectiveness (pse) - Walking scenario, long-term prediction, speed-heading approach**

<b>'recent' period (mins)</b>	<b>5</b>	<b>15</b>	<b>30</b>	<b>60</b>	<b>180</b>	<b>360</b>	<b>720</b>	<b>1440</b>
<b>no decay</b>	0.0E+00	0.0E+00	9.4E-09	3.9E-09	9.0E-10	1.2E-09	1.2E-09	2.3E-09
<b>linear</b>	0.0E+00	0.0E+00	1.4E-08	8.1E-09	1.5E-09	1.8E-09	1.7E-09	3.0E-09
<b>power (1.5)</b>	0.0E+00	0.0E+00	0.0E+00	1.2E-08	1.1E-08	1.2E-08	1.2E-08	1.0E-08
<b>power (2)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.8E-09	1.8E-08	1.8E-08	1.9E-08
<b>power (3)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
<b>mean</b>	0.0E+00	0.0E+00	4.7E-09	4.7E-09	4.1E-09	6.6E-09	6.7E-09	7.0E-09

**Table A1.12: Success rate (sr) - Walking scenario, long-term prediction, speed-heading approach**

<b>'recent' period (mins)</b>	<b>5</b>	<b>15</b>	<b>30</b>	<b>60</b>	<b>180</b>	<b>360</b>	<b>720</b>	<b>1440</b>
<b>no decay</b>	0.36	0.67	0.71	0.75	0.79	1.00	1.00	1.00
<b>linear</b>	0.24	0.63	0.71	0.76	0.76	0.99	0.99	0.98
<b>power (1.5)</b>	0.28	0.50	0.61	0.69	0.85	0.93	0.93	0.94
<b>power (2)</b>	0.21	0.35	0.38	0.48	0.64	0.77	0.76	0.76
<b>power (3)</b>	0.14	0.15	0.15	0.20	0.25	0.27	0.26	0.25
<b>mean</b>	0.25	0.46	0.51	0.58	0.66	0.79	0.79	0.79

## A1.2.2 Spatial proximity predictions

**Table A1.13: Median verification value (vv) - Walking scenario, long-term prediction, spatial proximity approach**

Buffer radius	100	250	500	750	1000	1500	2000	3000	5000	7500	10000
<b>no decay</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.38	1.38	1.38	1.38
<b>linear</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	2.13	2.72	3.07
<b>power (1.5)</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	1.21	2.07	3.25
<b>power (2)</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.78	1.60	2.93
<b>power (3)</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.16	0.47	1.15
<b>linear offset</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	1.61	1.46	1.33
<b>mean</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	1.21	1.62	2.19

**Table A1.14: Median surface area (sa) - Walking scenario, long-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>100</b>	<b>250</b>	<b>500</b>	<b>750</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>3000</b>	<b>5000</b>	<b>7500</b>	<b>10000</b>
<b>no decay</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>linear</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>power (1.5)</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>power (2)</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>power (3)</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>linear offset</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>mean</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08

**Table A1.15: Median prediction surface effectiveness (pse) - Walking scenario, long-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>100</b>	<b>250</b>	<b>500</b>	<b>750</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>3000</b>	<b>5000</b>	<b>7500</b>	<b>10000</b>
<b>no decay</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E-08	1.3E-08	5.8E-09	3.2E-09
<b>linear</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E-08	2.0E-08	1.1E-08	7.2E-09
<b>power (1.5)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.5E-08	1.1E-08	8.6E-09	7.6E-09
<b>power (2)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.9E-09	7.3E-09	6.7E-09	6.9E-09
<b>power (3)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.0E-09	1.5E-09	1.9E-09	2.7E-09
<b>linear offset</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.5E-08	1.5E-08	6.1E-09	3.1E-09
<b>mean</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.0E-08	1.1E-08	6.7E-09	5.1E-09

**Table A1.16: Success rate (sr) - Walking scenario, long-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>100</b>	<b>250</b>	<b>500</b>	<b>750</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>3000</b>	<b>5000</b>	<b>7500</b>	<b>10000</b>
<b>no decay</b>	0.00	0.00	0.01	0.08	0.16	0.26	0.68	0.95	0.97	0.99	1.00
<b>linear</b>	0.00	0.00	0.01	0.08	0.16	0.26	0.68	0.95	0.97	0.99	1.00
<b>power (1.5)</b>	0.00	0.00	0.01	0.08	0.16	0.26	0.68	0.95	0.97	0.99	1.00
<b>power (2)</b>	0.00	0.00	0.01	0.08	0.16	0.26	0.68	0.95	0.97	0.99	1.00
<b>power (3)</b>	0.00	0.00	0.01	0.08	0.16	0.26	0.68	0.95	0.97	0.99	1.00
<b>linear offset</b>	0.00	0.00	0.01	0.08	0.16	0.26	0.68	0.95	0.97	0.99	1.00
<b>mean</b>	0.00	0.00	0.01	0.08	0.16	0.26	0.68	0.95	0.97	0.99	1.00

## A2 Driving scenario

### A2.1 Short-term prediction (driving, t+10min)

#### A2.1.1 Speed-heading predictions

Table A1.17: Median verification value (vv) - Driving scenario, short-term prediction, speed-heading approach

'recent' period (mins)	5	15	30	60	180	360	720	1440
no decay	0.00	0.45	1.00	1.25	1.20	0.55	0.00	0.00
linear	0.00	0.00	0.84	1.64	1.78	1.17	1.07	0.06
power (1.5)	0.00	0.00	0.03	0.31	0.65	0.68	0.90	0.72
power (2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
power (3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
mean	0.00	0.09	0.37	0.64	0.73	0.48	0.39	0.16

**Table A1.18: Median surface area (sa) - Driving scenario, short-term prediction, speed-heading approach**

'recent' period (mins)	5	15	30	60	180	360	720	1440
<b>no decay</b>	3.8E+07	2.4E+08	3.8E+08	5.2E+08	6.1E+08	6.4E+08	6.1E+08	4.6E+08
<b>linear</b>	1.4E+07	1.6E+08	2.6E+08	4.7E+08	6.0E+08	6.3E+08	7.1E+08	6.3E+08
<b>power (1.5)</b>	2.2E+07	1.1E+08	1.3E+08	1.7E+08	1.8E+08	2.1E+08	2.2E+08	2.1E+08
<b>power (2)</b>	1.6E+07	5.7E+07	6.5E+07	7.4E+07	7.7E+07	7.8E+07	7.7E+07	8.2E+07
<b>power (3)</b>	8.8E+06	2.0E+07	2.2E+07	2.3E+07	2.3E+07	2.4E+07	2.5E+07	2.5E+07
<b>mean</b>	2.0E+07	1.2E+08	1.7E+08	2.5E+08	3.0E+08	3.2E+08	3.3E+08	2.8E+08

**Table A1.19: Median prediction surface effectiveness (pse) - Driving scenario, short-term prediction, speed-heading approach**

'recent' period (mins)	5	15	30	60	180	360	720	1440
<b>no decay</b>	0.0E+00	1.9E-09	2.9E-09	2.4E-09	2.1E-09	8.5E-10	0.0E+00	0.0E+00
<b>linear</b>	0.0E+00	0.0E+00	2.6E-09	3.4E-09	2.6E-09	1.8E-09	1.7E-09	9.4E-11
<b>power (1.5)</b>	0.0E+00	0.0E+00	3.4E-10	1.5E-09	2.3E-09	2.7E-09	3.4E-09	2.6E-09
<b>power (2)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
<b>power (3)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
<b>mean</b>	0.0E+00	3.8E-10	1.2E-09	1.5E-09	1.4E-09	1.1E-09	1.0E-09	5.4E-10

**Table A1.20: Success rate (sr) - Driving scenario, short-term prediction, speed-heading approach**

'recent' period (mins)	5	15	30	60	180	360	720	1440
<b>no decay</b>	0.36	0.80	0.88	0.88	0.89	0.68	0.49	0.41
<b>linear</b>	0.20	0.60	0.80	0.91	0.89	0.87	0.89	0.63
<b>power (1.5)</b>	0.26	0.56	0.63	0.69	0.77	0.76	0.77	0.78
<b>power (2)</b>	0.23	0.41	0.45	0.49	0.52	0.52	0.48	0.53
<b>power (3)</b>	0.17	0.25	0.23	0.23	0.24	0.25	0.26	0.28
<b>mean</b>	0.24	0.52	0.60	0.64	0.66	0.62	0.58	0.53

## A2.1.2 Spatial proximity predictions

**Table A1.21: Median verification value (vv) - Driving scenario, short-term prediction, spatial proximity approach**

Buffer radius	250	500	1000	5000	10000	15000	25000	50000	100000	250000
no decay	0.00	0.00	0.00	0.00	0.00	1.38	1.38	1.38	1.38	1.38
linear	0.00	0.00	0.00	0.00	0.00	0.47	1.90	2.94	3.51	3.89
power (1.5)	0.00	0.00	0.00	0.00	0.00	0.48	1.02	2.71	7.82	40.66
power (2)	0.00	0.00	0.00	0.00	0.00	0.23	0.62	2.30	9.44	84.98
power (3)	0.00	0.00	0.00	0.00	0.00	0.02	0.11	0.80	6.66	179.81
linear offset	0.00	0.00	0.00	0.00	0.00	1.13	1.61	1.43	1.17	1.00
mean	0.00	0.00	0.00	0.00	0.00	0.62	1.11	1.93	5.00	51.95

**Table A1.22: Median surface area (sa) - Driving scenario, short-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>250</b>	<b>500</b>	<b>1000</b>	<b>5000</b>	<b>10000</b>	<b>15000</b>	<b>25000</b>	<b>50000</b>	<b>100000</b>	<b>250000</b>
<b>no decay</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11
<b>linear</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11
<b>power (1.5)</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11
<b>power (2)</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11
<b>power (3)</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11
<b>linear offset</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11
<b>mean</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11

**Table A1.23: Median prediction surface effectiveness (pse) - Driving scenario, short-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>250</b>	<b>500</b>	<b>1000</b>	<b>5000</b>	<b>10000</b>	<b>15000</b>	<b>25000</b>	<b>50000</b>	<b>100000</b>	<b>250000</b>
<b>no decay</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-09	5.2E-10	1.3E-10	3.2E-11	5.2E-12
<b>linear</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.8E-10	7.1E-10	2.8E-10	8.2E-11	1.5E-11
<b>power (1.5)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.0E-10	3.8E-10	2.5E-10	1.8E-10	1.5E-10
<b>power (2)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E-10	2.3E-10	2.2E-10	2.2E-10	3.2E-10
<b>power (3)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E-11	4.2E-11	7.5E-11	1.6E-10	6.7E-10
<b>linear offset</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-09	6.1E-10	1.3E-10	2.7E-11	3.8E-12
<b>mean</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.4E-10	4.2E-10	1.8E-10	1.2E-10	2.0E-10

**Table A1.24: Success rate (sr) - Driving scenario, short-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>250</b>	<b>500</b>	<b>1000</b>	<b>5000</b>	<b>10000</b>	<b>15000</b>	<b>25000</b>	<b>50000</b>	<b>100000</b>	<b>250000</b>
<b>no decay</b>	0.00	0.00	0.00	0.06	0.37	0.84	1.00	1.00	1.00	1.00
<b>linear</b>	0.00	0.00	0.00	0.06	0.37	0.84	1.00	1.00	1.00	1.00
<b>power (1.5)</b>	0.00	0.00	0.00	0.06	0.37	0.84	1.00	1.00	1.00	1.00
<b>power (2)</b>	0.00	0.00	0.00	0.06	0.37	0.84	1.00	1.00	1.00	1.00
<b>power (3)</b>	0.00	0.00	0.00	0.06	0.37	0.84	1.00	1.00	1.00	1.00
<b>linear offset</b>	0.00	0.00	0.00	0.06	0.37	0.84	1.00	1.00	1.00	1.00
<b>mean</b>	0.00	0.00	0.00	0.06	0.37	0.84	1.00	1.00	1.00	1.00

## A2.2 Long-term prediction (driving, t+60min)

### A2.2.1 Speed-heading predictions

Table A1.25: Median verification value (vv) - Driving scenario, long-term prediction, speed-heading approach

'recent' period (mins)	5	15	30	60	180	360	720	1440
no decay	0.00	0.00	0.35	0.53	1.80	2.09	0.93	0.00
linear	0.00	0.00	0.10	0.44	1.68	1.13	2.30	1.20
power (1.5)	0.00	0.00	0.35	0.46	2.08	1.99	0.91	0.00
power (2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
power (3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
mean	0.00	0.00	0.16	0.29	1.11	1.04	0.83	0.24

**Table A1.26: Median surface area (sa) - Driving scenario, long-term prediction, speed-heading approach**

'recent' period (mins)	5	15	30	60	180	360	720	1440
<b>no decay</b>	1.2E+09	7.3E+09	1.1E+10	1.5E+10	2.1E+10	2.1E+10	1.9E+10	8.5E+09
<b>linear</b>	5.6E+08	5.5E+09	8.6E+09	1.2E+10	2.0E+10	2.1E+10	2.1E+10	2.1E+10
<b>power (1.5)</b>	1.3E+09	6.8E+09	1.0E+10	1.5E+10	2.1E+10	2.1E+10	1.8E+10	9.4E+09
<b>power (2)</b>	5.9E+08	1.7E+09	2.2E+09	2.4E+09	2.4E+09	2.5E+09	2.4E+09	2.5E+09
<b>power (3)</b>	3.8E+08	6.6E+08	7.9E+08	8.1E+08	8.4E+08	7.2E+08	7.4E+08	7.9E+08
<b>mean</b>	8.1E+08	4.4E+09	6.5E+09	9.1E+09	1.3E+10	1.3E+10	1.2E+10	8.4E+09

**Table A1.27: Median prediction surface effectiveness (pse) - Driving scenario, long-term prediction, speed-heading approach**

<b>'recent' period (mins)</b>	<b>5</b>	<b>15</b>	<b>30</b>	<b>60</b>	<b>180</b>	<b>360</b>	<b>720</b>	<b>1440</b>
<b>no decay</b>	0.0E+00	0.0E+00	3.2E-11	3.6E-11	8.6E-11	8.6E-11	4.2E-11	0.0E+00
<b>linear</b>	0.0E+00	0.0E+00	1.0E-11	4.1E-11	7.3E-11	5.5E-11	8.6E-11	4.3E-11
<b>power (1.5)</b>	0.0E+00	0.0E+00	2.7E-11	3.1E-11	9.3E-11	8.9E-11	3.6E-11	0.0E+00
<b>power (2)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
<b>power (3)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
<b>mean</b>	0.0E+00	0.0E+00	1.4E-11	2.2E-11	5.0E-11	4.6E-11	3.3E-11	8.7E-12

**Table A1.28: Success rate (sr) - Driving scenario, long-term prediction, speed-heading approach**

<b>'recent' period (mins)</b>	<b>5</b>	<b>15</b>	<b>30</b>	<b>60</b>	<b>180</b>	<b>360</b>	<b>720</b>	<b>1440</b>
<b>no decay</b>	0.20	0.55	0.79	0.80	0.80	0.59	0.58	0.41
<b>linear</b>	0.08	0.46	0.71	0.80	0.82	0.79	0.80	0.58
<b>power (1.5)</b>	0.19	0.53	0.76	0.79	0.80	0.59	0.58	0.42
<b>power (2)</b>	0.07	0.21	0.25	0.27	0.26	0.28	0.24	0.30
<b>power (3)</b>	0.04	0.07	0.08	0.11	0.10	0.09	0.09	0.12
<b>mean</b>	0.12	0.36	0.52	0.55	0.56	0.47	0.46	0.37

## A2.2.2 Spatial proximity predictions

Table A1.29: Median verification value (vv) - Driving scenario, long-term prediction, spatial proximity approach

Buffer radius	250	500	1000	5000	10000	15000	25000	50000	100000	250000
no decay	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.38	1.38
linear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.49	3.14
power (1.5)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	3.64
power (2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	3.40
power (3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	1.44
linear offset	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.53	1.33
mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95	2.39

**Table A1.30: Median surface area (sa) - Driving scenario, long-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>250</b>	<b>500</b>	<b>1000</b>	<b>5000</b>	<b>10000</b>	<b>15000</b>	<b>25000</b>	<b>50000</b>	<b>100000</b>	<b>250000</b>
<b>no decay</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11
<b>linear</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11
<b>power (1.5)</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11
<b>power (2)</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11
<b>power (3)</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11
<b>linear offset</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11
<b>mean</b>	2.7E+05	1.1E+06	4.3E+06	1.1E+08	4.3E+08	9.6E+08	2.7E+09	1.1E+10	4.3E+10	2.7E+11

**Table A1.31: Median prediction surface effectiveness (pse) - Driving scenario, long-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>250</b>	<b>500</b>	<b>1000</b>	<b>5000</b>	<b>10000</b>	<b>15000</b>	<b>25000</b>	<b>50000</b>	<b>100000</b>	<b>250000</b>	
<b>no decay</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-11	5.2E-12
<b>linear</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.5E-11	1.2E-11
<b>power (1.5)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-11	1.4E-11
<b>power (2)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.0E-11	1.3E-11
<b>power (3)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-12	5.4E-12
<b>linear offset</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E-11	5.0E-12
<b>mean</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.2E-11	9.0E-12

**Table A1.32: Success rate (sr) - Driving scenario, long-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>250</b>	<b>500</b>	<b>1000</b>	<b>5000</b>	<b>10000</b>	<b>15000</b>	<b>25000</b>	<b>50000</b>	<b>100000</b>	<b>250000</b>
<b>no decay</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.29	1.00	1.00
<b>linear</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.29	1.00	1.00
<b>power (1.5)</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.29	1.00	1.00
<b>power (2)</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.29	1.00	1.00
<b>power (3)</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.29	1.00	1.00
<b>linear offset</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.29	1.00	1.00
<b>mean</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.29	1.00	1.00

## A3 Daily migration scenario

### A3.1 Short-term prediction (daily migration, t+10min)

#### A3.1.1 Speed-heading predictions

Table A1.33: Median verification value (vv) – Daily migration scenario, short-term prediction, speed-heading approach

'recent' period (mins)	5	15	30	60	180	360	720	1440
no decay	0.48	1.78	2.46	2.08	2.01	1.62	0.00	0.00
linear	0.01	2.69	2.54	2.12	1.35	1.67	1.01	0.00
power (1.5)	0.00	2.58	2.98	2.32	2.64	3.21	2.80	1.49
power (2)	0.15	1.28	1.52	1.76	1.55	1.94	1.29	1.15
power (3)	0.00	0.00	0.00	0.00	0.05	0.00	0.08	0.00
mean	0.13	1.66	1.90	1.66	1.52	1.69	1.04	0.53

**Table A1.34: Median surface area (sa) – Daily migration scenario, short-term prediction, speed-heading approach**

'recent' period (mins)	5	15	30	60	180	360	720	1440
<b>no decay</b>	8.3E+06	3.3E+07	2.8E+07	2.7E+07	2.7E+07	2.8E+07	1.4E+07	1.9E+06
<b>linear</b>	3.6E+06	9.8E+06	1.3E+07	1.0E+07	9.7E+06	8.6E+06	1.0E+07	2.6E+06
<b>power (1.5)</b>	7.1E+06	1.6E+07	1.5E+07	1.7E+07	1.5E+07	1.5E+07	1.2E+07	9.7E+06
<b>power (2)</b>	5.3E+06	1.0E+07	6.9E+06	7.7E+06	7.9E+06	8.3E+06	7.2E+06	7.4E+06
<b>power (3)</b>	2.7E+06	3.9E+06	3.8E+06	3.2E+06	3.3E+06	3.8E+06	3.9E+06	3.2E+06
<b>mean</b>	5.4E+06	1.5E+07	1.3E+07	1.3E+07	1.3E+07	1.3E+07	9.5E+06	5.0E+06

**Table A1.35: Median prediction surface effectiveness (pse) – Daily migration scenario, short-term prediction, speed-heading approach**

'recent' period (mins)	5	15	30	60	180	360	720	1440
<b>no decay</b>	1.1E-07	6.1E-08	7.0E-08	8.3E-08	6.3E-08	8.1E-08	6.5E-09	0.0E+00
<b>linear</b>	2.1E-08	1.0E-07	1.1E-07	1.1E-07	9.5E-08	1.5E-07	5.7E-08	0.0E+00
<b>power (1.5)</b>	6.6E-08	1.5E-07	1.3E-07	1.4E-07	1.7E-07	1.8E-07	1.6E-07	5.7E-08
<b>power (2)</b>	5.7E-08	1.6E-07	1.6E-07	1.4E-07	1.8E-07	1.4E-07	1.4E-07	6.0E-08
<b>power (3)</b>	0.0E+00	9.4E-09	0.0E+00	1.1E-08	1.5E-08	2.1E-08	2.2E-08	4.0E-10
<b>mean</b>	5.2E-08	9.7E-08	9.4E-08	9.8E-08	1.0E-07	1.1E-07	7.7E-08	2.3E-08

**Table A1.36: Success rate (sr) – Daily migration scenario, short-term prediction, speed-heading approach**

<b>'recent' period (mins)</b>	<b>5</b>	<b>15</b>	<b>30</b>	<b>60</b>	<b>180</b>	<b>360</b>	<b>720</b>	<b>1440</b>
<b>no decay</b>	0.83	0.78	0.83	0.83	0.83	0.83	0.50	0.05
<b>linear</b>	0.56	0.78	0.78	0.78	0.78	0.78	0.78	0.16
<b>power (1.5)</b>	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.68
<b>power (2)</b>	0.72	0.67	0.72	0.67	0.67	0.67	0.67	0.68
<b>power (3)</b>	0.50	0.61	0.56	0.56	0.56	0.56	0.67	0.58
<b>mean</b>	0.66	0.70	0.71	0.70	0.70	0.70	0.66	0.43

### A3.1.2 Spatial proximity predictions

**Table A1.37: Median verification value (vv) – Daily migration scenario, short-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>100</b>	<b>250</b>	<b>500</b>	<b>750</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>3000</b>	<b>5000</b>	<b>7500</b>	<b>10000</b>
<b>no decay</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.38	1.38	1.38	1.38
<b>linear</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	2.28	2.88	3.14
<b>power (1.5)</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.55	0.11	0.07
<b>power (2)</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.13	0.01	0.01
<b>power (3)</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>linear offset</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.38	1.71	1.45	1.33
<b>mean</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	1.01	0.97	0.99

**Table A1.38: Median surface area (sa) – Daily migration scenario, short-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>100</b>	<b>250</b>	<b>500</b>	<b>750</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>3000</b>	<b>5000</b>	<b>7500</b>	<b>10000</b>
<b>no decay</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>linear</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>power (1.5)</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>power (2)</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>power (3)</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>linear offset</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08
<b>mean</b>	4.3E+04	2.7E+05	1.1E+06	2.4E+06	4.3E+06	9.6E+06	1.7E+07	3.8E+07	1.1E+08	2.4E+08	4.3E+08

**Table A1.39: Median prediction surface effectiveness (pse) – Daily migration scenario, short-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>100</b>	<b>250</b>	<b>500</b>	<b>750</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>3000</b>	<b>5000</b>	<b>7500</b>	<b>10000</b>
<b>no decay</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E-08	1.3E-08	5.8E-09	3.2E-09
<b>linear</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.7E-08	2.1E-08	1.2E-08	7.4E-09
<b>power (1.5)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.1E-09	5.1E-09	4.4E-10	1.7E-10
<b>power (2)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.6E-10	1.2E-09	6.0E-11	2.0E-11
<b>power (3)</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E-12	4.0E-11	6.7E-13	1.7E-13
<b>linear offset</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E-08	1.6E-08	6.1E-09	3.1E-09
<b>mean</b>	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.7E-08	9.5E-09	4.1E-09	2.3E-09

**Table A1.40: Success rate (sr) – Daily migration scenario, short-term prediction, spatial proximity approach**

<b>Buffer radius</b>	<b>100</b>	<b>250</b>	<b>500</b>	<b>750</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>3000</b>	<b>5000</b>	<b>7500</b>	<b>10000</b>
<b>no decay</b>	0.05	0.05	0.05	0.05	0.05	0.16	0.42	1.00	1.00	1.00	1.00
<b>linear</b>	0.05	0.05	0.05	0.05	0.05	0.16	0.42	1.00	1.00	1.00	1.00
<b>power (1.5)</b>	0.05	0.05	0.05	0.05	0.05	0.16	0.42	1.00	1.00	1.00	1.00
<b>power (2)</b>	0.05	0.05	0.05	0.05	0.05	0.16	0.42	1.00	1.00	1.00	1.00
<b>power (3)</b>	0.05	0.05	0.05	0.05	0.05	0.16	0.42	1.00	1.00	1.00	1.00
<b>linear offset</b>	0.05	0.05	0.05	0.05	0.05	0.16	0.42	1.00	1.00	1.00	1.00
<b>mean</b>	0.05	0.05	0.05	0.05	0.05	0.16	0.42	1.00	1.00	1.00	1.00

### A3.1.3 Temporal proximity predictions

Table A1.41: Median verification value (vv) – Daily migration scenario, short-term prediction, temporal proximity approach

Time budget	5	10	15	20	25	30
buffer (250m)	0.00	0.00	1.00	1.00	1.00	1.00
convex hull	0.00	0.00	0.00	1.00	1.00	1.00
mean	0.00	0.00	1.00	1.00	1.00	1.00

**Table A1.42: Mean surface area (sa) – Daily migration scenario, short-term prediction, temporal proximity approach**

<b>Time budget</b>	<b>5</b>	<b>10</b>	<b>15</b>	<b>20</b>	<b>25</b>	<b>30</b>
<b>buffer (250m)</b>	4.6E+05	6.4E+05	8.0E+05	8.0E+05	8.4E+05	1.1E+06
<b>convex hull</b>	3.7E+05	1.1E+06	2.0E+06	3.2E+06	3.9E+06	4.6E+06
<b>mean</b>	4.1E+05	8.6E+05	1.4E+06	2.0E+06	2.4E+06	2.8E+06

**Table A1.43: Mean prediction surface effectiveness (pse) – Daily migration scenario, short-term prediction, temporal proximity approach**

<b>Time budget</b>	<b>5</b>	<b>10</b>	<b>15</b>	<b>20</b>	<b>25</b>	<b>30</b>
<b>buffer (250m)</b>	0.0E+00	0.0E+00	1.3E-06	1.3E-06	1.2E-06	9.5E-07
<b>convex hull</b>	0.0E+00	0.0E+00	0.0E+00	3.1E-07	2.5E-07	2.2E-07
<b>mean</b>	0.0E+00	0.0E+00	6.3E-07	7.8E-07	7.3E-07	5.8E-07

**Table A1.44: Success rate (sr) – Daily migration scenario, short-term prediction, temporal proximity approach**

<b>Time budget</b>	<b>5</b>	<b>10</b>	<b>15</b>	<b>20</b>	<b>25</b>	<b>30</b>
<b>buffer (150m)</b>	0.09	0.45	0.91	0.91	0.91	0.91
<b>convex hull</b>	0.00	0.18	0.45	0.64	0.64	0.73
<b>mean</b>	0.05	0.32	0.68	0.77	0.77	0.82