Monitoring Moving Range Queries within Dynamic Safe

Regions

The application file name is Model3ProjV09b\_7.exe. The application runs on Windows NT and Windows XP, 7 and 8.

The data sets produced with this application are in the accompanying files StaticResult.xlsx and continuous Result.xlsx.

The screen shot below shows the application open at default settings and the result of a single trial – which is a moving query. The RHS panel shows an image of the random scenario generated. Each of the objects is shown as a small black dot representing the query radius. The path travelled by the query is shown as a red line. The LHS panel shows the summary statistics from this scenario in a text box. These are described below. Summary statistics can be copied and pasted into a word processor or spread sheet. An example of a static query is shown on the following page.

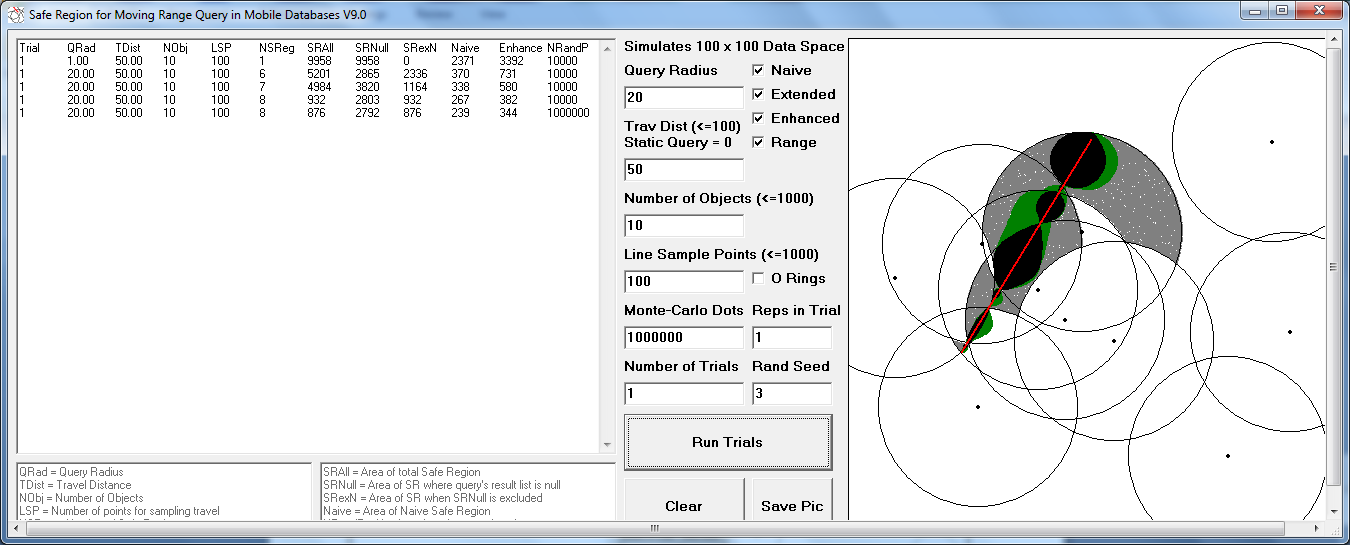


Figure 1: ***Example of a Moving Query***

***Inputs to the model:***

Sampling Data Space – all queries and travel distances are located within a 100 unit x 100 unit data space, having a total area of 10000 units2. This region is shown on the RHS of the application window. The area of the sampling data space cannot be changed by the user.

Query Radius – determines the region over which each object will be seen by the query. Object locations are shown as small black points in RHS image. Query Radius can be a real number (i.e. 4.5 units etc.)

Travel Distance – distance travelled, assuming a moving query. This can be in the range 0 – 100 units. For a static query put distance = 0. Travel path is shown as a red line in RHS image. Travel Distance can be a real number (i.e. 4.5 units etc.)

Number of Objects – self-explanatory.

Line Sample Points – the number of equally spaced points along the travel distance at which the moving query is evaluated. Default = 100 but up to 1000 points can be sampled.

Number of Random Dot Points – these are used to evaluate the area of the Safe Region using Monte-Carlo simulation. More random dot points will give a more accurate area measure however the application will run more slowly.

Number of Trials – Up to 1000 trials can be run at a single parameter combination.

Reps in Trial – Up to 1000 repetitions of any trial can be performed. Trial settings are held fixed and Monte-Carlo integrals recalculated.

Naïve – Tick this option to calculate the area of the Naïve (Basic) Safe Region.

Extended – Tick this option to calculate the area of the Extended Safe Region.

Enhanced – Tick this option to calculate the area of the Enhanced Safe Region.

O Rings – Tick this option to show the construction of the Naïve Safe Region.

***Outputs from the model:***

QRad – Query Radius

TDist – Travel Distance

NObj – Number of Objects

LSP – Line Sample Points

NSReg – The number of Safe Regions in the query result. This count includes the region where the query results in a Null Response.

SRAll – The total area of all Extended Safe Regions in units2.

SRNull – The area of the Extended Safe Region in units2 corresponding to a null (no-object) response.

SRexN – The area of the Extended Safe Region excluding the no-object response in units2. This is then the area of the Safe Region corresponding to a positive query result.

Naïve - The total area of all Naïve (Basic) Safe Regions in units2.

Enhanced - The total area of all Enhanced Safe Regions in units2.

NRandP – The number of random dot points used to calculate the area of the Safe Regions using Monte-Carlo simulation.

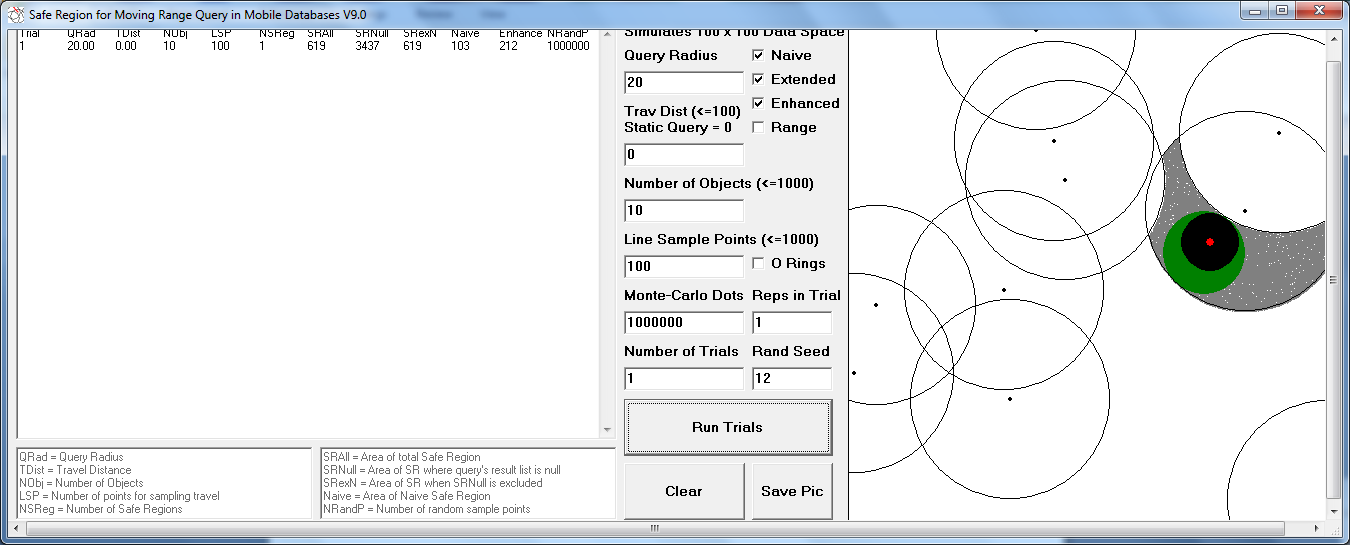


Figure 2: ***Example of a Static Query***