Advancements in Spatial Analytics

Lauren Rosenshein demonstrates the new tools in ArcGIS 10.1 to identify patterns, trends, and relationships in your data.

http://video.esri.com/watch/1078/advancements-in-spatial-analytics

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Video Transcription

00:01 Journal entry, November 18th. My visit to the US Coast Guard triggered a childhood memory of water.

00:08 For some reason, as a kid, I thought it would be a great idea to jump in the deep end of a pool before I knew how to swim.

00:14 I was drowning, and it seemed like an eternity passed before the lifeguard fished me out.

00:19 I cannot even imagine being lost at sea. The terror and the fear of being forgotten would be overwhelming...

00:26 ...and the hope of someone finding me would seem next to impossible. Search and rescue facts are astounding.

00:33 The Coast Guard responds to 30,000 cases per year. About 10 percent of these calls are significant events...

00:40 ...which can require multiple days of searching with costs that can exceed $20,000 per hour.

00:46 Cost aside, survivability radically decreases over time. Every second truly matters...

00:52 ...whether in the cold Alaskan waters or the relatively warm Caribbean.

00:57 Even with the wealth of geospatial information and processing, the ability to predict a location gets complex...

01:04 ...when based on an iffy distress position or voyage plan and sea currents and wind.

01:11 The creation of a sound search plan gets exponentially more complex when adding in waves heights, sun...

01:17 ...angles, weather, and available resources. To the rescue come SAROPS...

01:22 ...Search and Rescue Optimum Planning System...

01:25 ...a desktop planning application for the Coast Guard search and rescue controllers, developed by a small...

01:31 ...cross-discipline team of incredible mathematicians, oceanographers, system engineers, and designers.

01:38 Inputting the type of search object--for example, a person, life raft, or vessel, which all behave differently...

01:44 ...SAROPS models the predistress motion and utilizes particle filters with up to 10,000 individual particles...

01:51 ...to create time-based drift models that focus searching on those areas of highest probability.

01:58 With these sophisticated models, your chances of being found have never been better.

02:03 SAROPS, lives, dollars, property, and fuel--saved, and the black box flight recorder from the...

02:10 ...Air France plane that crashed off Brazil--found. The story gets better.

02:15 The use of SAROPS is deployed beyond the US. If you're lost in waters off places like Malta, Mexico...

02:22 ...Lebanon, or Vietnam, you'll find their search and rescue teams also guided by SAROPS, great geographic...

02:29 ...science shared around the world. Now, SAROPS--it's the result of a classic GIS pattern.

02:38 Identify a problem, solve the problem through spatial analysis, integrate external scientific methods...

02:45 ...automate the workflow to run in minutes what used to take hours, and reduce human errors and biases.

02:51 And then share that knowledge with others as a repeatable capability. For our next demonstration...

02:57 ...on advancements in spatial analysis with ArcGIS 10.1, please welcome Lauren Rosenshein.

03:05 Thanks, Don. This is a map of gas prices in Los Angeles County.

03:12 What are you doing right now when you look at this map?

03:17 Whenever we look at a map, we naturally, intuitively start looking for patterns and trends in our data.

03:24 Sometimes those patterns are easy to see, like maybe we have a cluster of higher gas prices in the...

03:30 ...Hollywood-Beverly Hills area in the northwest area of Los Angeles.

03:36 Sometimes those patterns are harder to find. What if you were asked to find four distinct regions in this area...

03:44 ...based on gas prices? Would you notice that there's a cluster of lower gas prices surrounded by...

03:52 ...higher prices on the coast, or a cluster of moderate prices surrounded by lower prices on the inland area?

04:00 Or, in this example, in central Nevada, concentrations of gold, silver, and copper.

04:08 What kinds of patterns or trends do you see here?

04:12 This kind of analysis becomes increasingly difficult when we have 3 variables, or 10 variables…

04:20 …or thousands or tens of thousands of samples, but there are patterns here--some regional patterns…

04:29 …as well as local clusters of gold, silver, and copper, higher concentrations surrounded by lower concentrations.

04:38 What we want to do today is show you how the new tools in ArcGIS 10.1 can help you turn your complex data…

04:46 …into valuable information about patterns, trends, and relationships. So let's take a look in an example…

04:53 …of using these tools in an analysis of the economic landscape of northern New Jersey.

05:01 Here we're looking at income, but we know that income is just a tiny piece of the puzzle if we want to understand…

05:08 …something complex, like the economic landscape of an area. We might also be interested in things…

05:15 …like the housing market. Here we have the percent of vacant homes in the area. Or we might want to look at something…

05:21 …like unemployment rates. But making sense of these disparate datasets by looking at map after map after map…

05:29 …is virtually impossible. A new tool in ArcGIS 10.1, Grouping Analysis, can help us find the patterns…

05:37 …that exist in our data. So we'll use the Grouping Analysis tool and choose the dataset that we want to analyze.

05:50 We'll choose the number of groups that we want to find and the variables that we want to include in our analysis.

05:58 We'll also set a spatial constraint because in this analysis, we want to make sure that the groups that we create…

06:04 …are spatially contiguous. Now, what Grouping Analysis is doing behind the scenes here is it's creating these four…

06:12 …groups so that within each group, the features are as alike as they can be, based on those three variables that we chose.

06:19 And between groups, the features are as different as they can be, based on those variables.

06:25 And we're making sure that those groups are spatially contiguous.

06:33 So right away, we can see the spatial pattern, but the truth is, we can't really understand what this pattern is showing us…

06:41 …unless we look at another part of the output of the Grouping Analysis tool. This report shows us that…

06:49 …the blue group in the center of our study area has a high unemployment rate, a high vacancy rate, and a…

06:56 …low median household income. Our green and our yellow groups are in the middle, and the red group…

07:02 …has a low unemployment rate, a low vacancy rate, and a high median household income, so…

07:07 …it's doing pretty well in terms of these three indicators. Now at this point, we've found the patterns or…

07:14 …in this case, the regions of the economic landscape of northern New Jersey. Another thing that we do naturally…

07:21 …whenever we look at a map is try to find or understand relationships that exist in our data.

07:28 Understanding why things happen is a very important first step for implementing policies and programs…

07:35 …that can help change people's lives. Unemployment is one issue that's impacting this area…

07:41 …and the next thing that we want to do is take a look and explore some of the potential contributing factors.

07:48 So what variables do you guys think would help us model unemployment in this area, or in your own hometown?

07:57 We probably all have different lists of variables that we think might be related to unemployment.

08:03 Another new tool in ArcGIS 10.1, Exploratory Regression, can help us figure out which of those variables…

08:11 …really are good predictors of unemployment. We've created a model which runs Exploratory Regression…

08:19 …once for each of the groups that we created using Grouping Analysis.

08:27 Exploratory Regression lets us choose all the variables that we think might be related.

08:33 And what Exploratory Regression is doing is it's testing all the different combinations of those variables…

08:40 …looking for variables that are consistently doing a good job of explaining unemployment, variables…

08:45 …that are consistently statistically significant in the models that are being tested.

08:51 And we're running this analysis on each of the three groups that we created using Grouping Analysis because…

08:57 …we already know that these three regions have distinct economic characteristics.

09:02 If these geographies have distinct characteristics, it would follow that the variables that help us explain unemployment…

09:11 …in one region may be very different than the variables that help us explain unemployment in other regions.

09:17 Geography really matters in an analysis like this. This report shows us the results of that analysis.

09:27 It shows us that in the blue group, there's two education variables that are very important for predicting unemployment.

09:33 In our yellow group, one variable that's important is a female head of household variable, indicating that…

09:40 …programs or policies focused on empowering single, working mothers may be effective in this region.

09:46 And in the green group, the female head of household variable's important, but there are other variables that show up…

09:50 …too, like a technology industry variable. So three different regions, three totally different sets of variables…

09:57 …that help us understand unemployment. Now at this point, we're done with our analysis…

10:04 …and the last thing that we want to do is share our analysis, and in ArcGIS 10.1, sharing our analysis is really easy…

10:11 …using the new geoprocessing package. A very important first step for sharing any analysis…

10:17 …is documenting our methodology. So this report already outlines the workflow that we've walked through…

10:24 …in this analysis this afternoon. Now, sharing our analysis is as easy as right-clicking on our result…

10:32 …and choosing to share it as a geoprocessing package.

10:35 We can include additional files, like that PDF report that we created.

10:40 And when we hit Share, it's taking all of our input data and our output data…

10:44 …our model, including any nested models or scripts…

10:47 …our methodology; putting it into a geoprocessing package that we can then share within our organization or…

10:53 …with a much broader audience. I really believe that spatial analytics are at the heart of GIS.

11:02 And being able to share our analysis will help everyone better understand our world.