ABSTRACT
Nowadays, there are more and more people love traveling or just get out for leisure with bike, a healthy and environmental-friendly travel mode. And route guidance with which they can get beautiful view of nature is quite necessary. Considering these situations, this project takes San Francisco as the study area, and explores ways of assessing road segment scenic degree. The bike line scenic index is analyzed based on raster aspect, taking into considerations of scenery visibility, wood density and also distance to hot scenery shooting site. Finally, a Web Mapping Application is built, where users can calculate scenic index according to their own interest, and generate biking route which is the most scenic.

1. Bike Line Scenic Index Calculation

**DATA PREPARATION**

The scenic index is evaluated through analyzing scenery visibility and distance to popular view sites.

- The scenery factors includes: Tree Canopy, Inland Water (Lake/River), Coast, Tourist and Leisure Attractions.
- Besides, Flickr photos are also taken into consideration. The Flickr photos are searched and downloaded through Flickr API for Python, and are classified with SUN Attribute Dataset (which is a scene attribute classifier for picture) using MatLab. So only pictures of scenery are included.
- Tree density and also dis

**SCENIC INDEX**

- Viewshed are applied to the scenery factors including coastline, inland water and attraction sites. The viewshed result indicates how many times of the scenery features can be viewed from each cell.
- To evaluate tree density along the roads, Kernel Density is applied to tree canopy.
- For scenery photos Euclidean Distance is applied to the photo locations to indicate how far it is to the photo sites. Besides, kernel density is also created with photo points, to help indicate which sites are more popular.
- The factor results are reclassified with grade from 1-10, and through Cell Statistics the factors grades are combined equally as default Scenic Index and it is assigned to bike line cells. The bike line then can show where people can see pretty scenery.

**Route Analysis with Spatial Analyst tool**

To analyze route from raster perspective. Flow Direction tool or Cost Path tool can be helpful. Here Flow Direction is used. Bike line Scenic Index layer is first reclassified, where the higher the index the lower cost, and non-bike line cells are assigned very high cost in order to keep route on the normal line. Then based on the bike-line index cost and trail origin point, Cost Distance and Flow Direction are created. For route generation, Flow Accumulation is applied based on Flow Direction result and trail destination location. The example is given below.

**Route Analysis with Web APP**

The route analysis using Spatial Analyst tool in ArcGIS can offer the result precisely, but cannot offer direction guide like Network Analyst. Also different users focus on different scenery factors. So a Web APP where users can choose the scenic index based on their own interest, and search route, as well as view scenery photos in the area they want to explore, is very useful. The bike line layer summarized the cells’ scenic index as mean value to each segment using Zonal Statistics tool. And the layer is published to the ArcGIS Map Server. Using HTML, CSS, JavaScript, ArcGIS API for JavaScript and Flickr API, The web app demo is built show as the screenshots below.