# CS 513: Geospatial Vision and Visualization

## Description

Geospatial information has become ubiquitous in everyday life, as evidenced by on-line mapping services such as NOKIA Here Map, Microsoft Bing Map, the "place" features on social network websites such as Facebook, and navigation apps on smart phones. Behind the scenes is digital map content engineering that enables all types of location-based services. Course material will be drawn from the instructor's research and development experience at HERE, a Nokia company (formerly NAVTEQ), the Chicago-based leading global provider of digital map, traffic and location data. This course will provide comprehensive treatment of computer vision, image processing and visualization techniques in the context of digital mapping, global positioning and sensing, next generation map making, and three-dimensional map content creations. Real world problems and data and on-site industry visits will comprise part of the course curriculum.

## Syllabus

1. Course overview, digital mapping state of the art, next generation mapping technologies – mobile mapping
2. Next generation mapping  technologies – probe data, vsiuals, mobile apps, adas, indoor, HW1 street view comparison
3. Georeferenced street level imagery – image formation, image enhancement, matlab demo/tutorial
4. Image processing, basic geodesy, HW2 lens smear detection
5. GPS, panoramic image creation – image mosaics
6. Panoramic image creation – homography, 360 panoram, aerial/satellite imaging, HW 3 aerial image retrieval
7. HW review, morphological operations, hough transform, HW4 automatic water body detection
8. 3D stereo, LIDAR, Class project: LIDAR for road attribution for autonomous driving
9. Case study: 4D Dynamic City Rendering, image based feature extraction – edge, local feature descriptors, Gaussian filter
10. Scale invariant feature transform, feature matching
11. Image based feature extraction – adaboost, haar feature, texture analysis, HW5 traffic signal detection
12. Case study: probe data mining
13. Case study: Geospatial Entrepreneurship, map API tutorial
14. HW review, advanced topics
15. Class project presentation
16. Final exam