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April 29, 2018

GGG 412

GGG 412 Mini Project

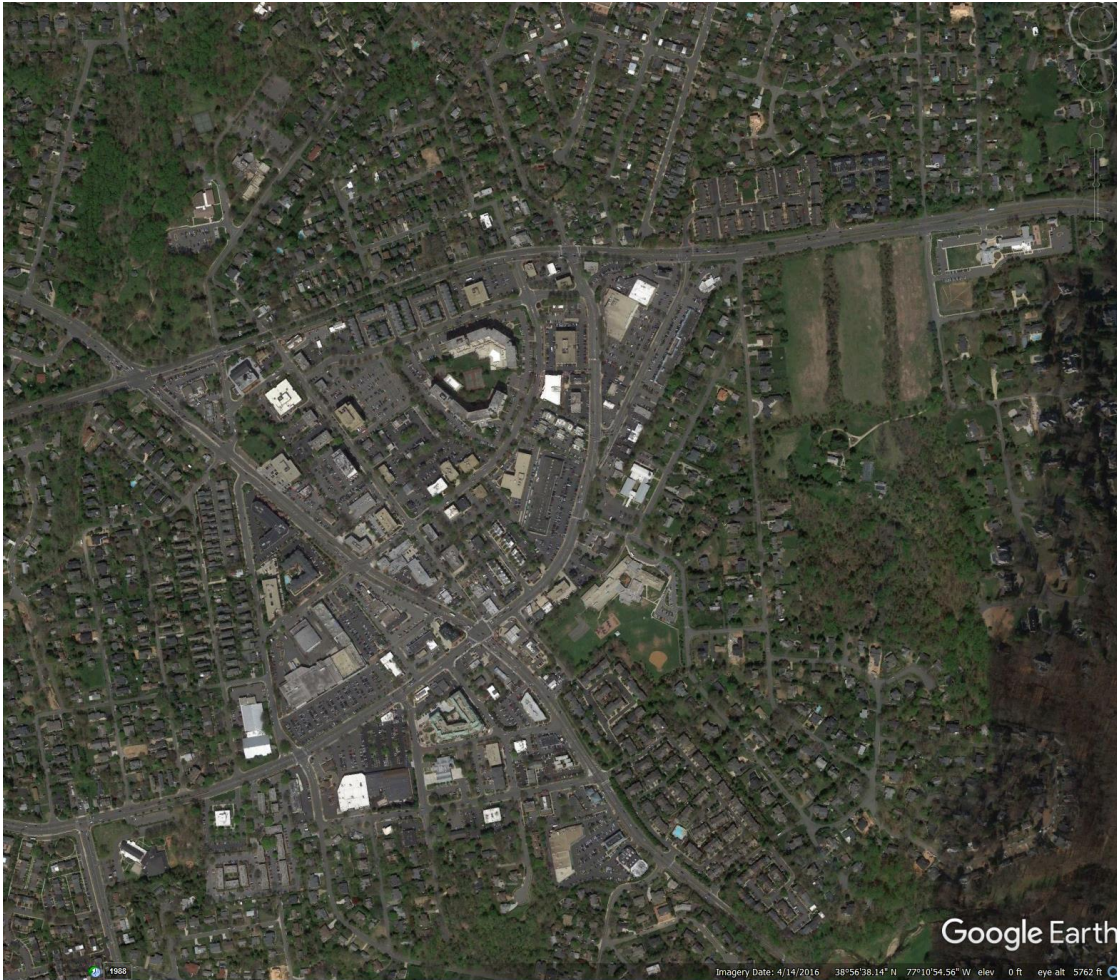
Analyzing McLean, Virginia

Introduction

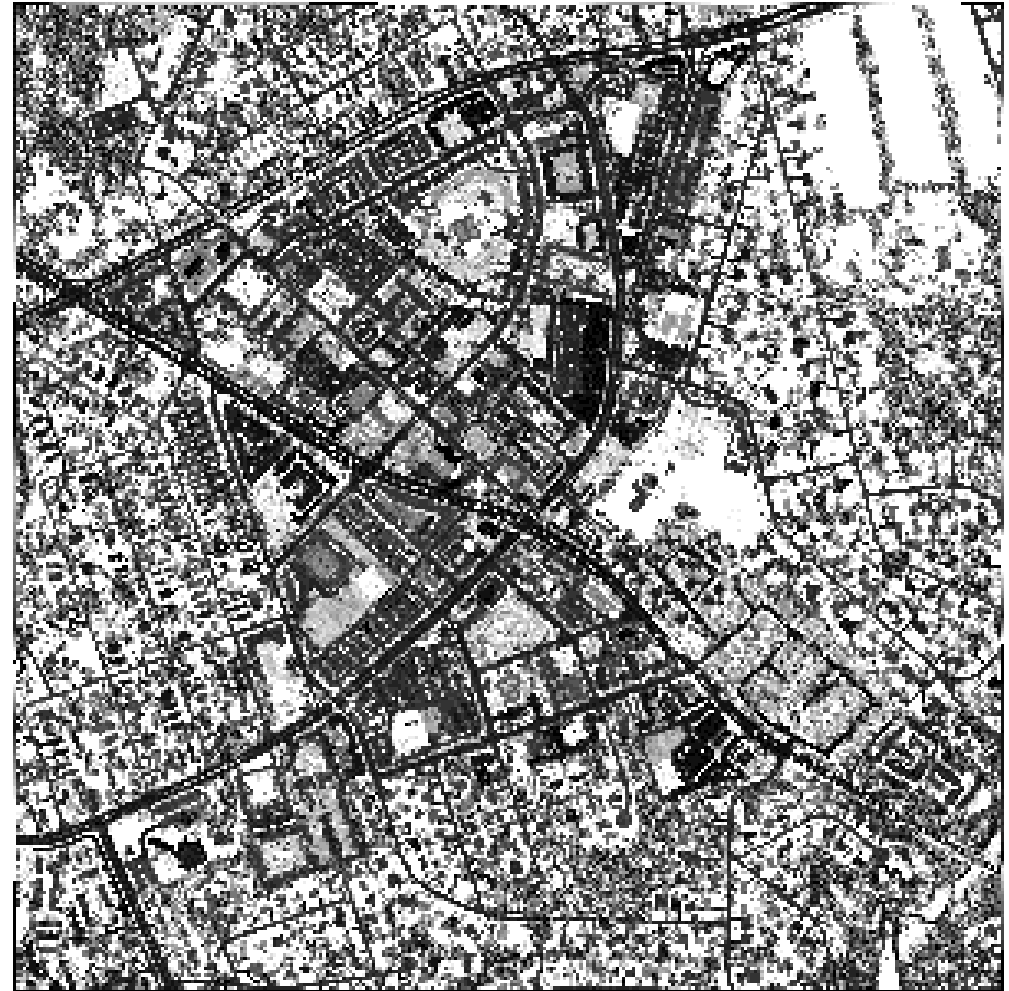
For this project, I will be analyzing various images of McLean, Virginia that were taken over the past few decades. I used several image types (Aerial Photography, Landsat, LiDAR, Google Earth) that varied in resolution and scale. These images were acquired as far back as the early 1980s. Most of the data (except for the Google Earth screenshot) was acquired through EarthExplorer.

I used both photo-interpretation and classification techniques on these images. Specifically, I used Spectral Angle Mapping (SAM) classification to separate urban centers from the rest of the images. SAM classification was done using ENVI.

Introduction: McLean, Virginia as of today



McLean, Virginia
Google Earth Screenshot
Taken April 14, 2016

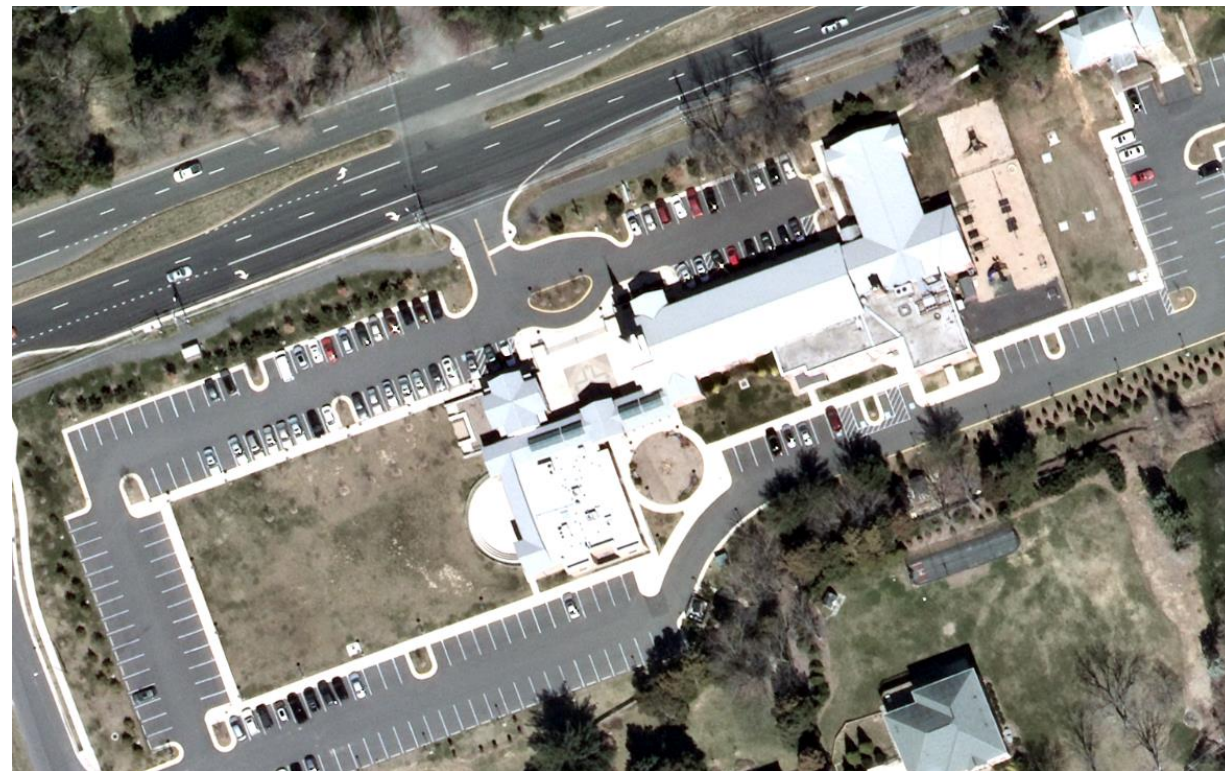


McLean, Virginia
Radar (LiDAR) Intensity Image
Taken February 15, 2012

Analyzing Change Over Time: Trinity United Methodist Church



High Resolution Orthoimagery
Taken February 1, 2002
McLean, Virginia



High Resolution Orthoimagery
Taken February 14, 2013
McLean, Virginia

Trinity United Methodist Church: How has it changed over the past decade?

Based on the timespan of around a decade (2002 to 2013), several changes have occurred at the site of Trinity United Methodist Church. Using various photo-interpretation elements, we can observe that:

- Between 2002 and 2013, there was a renovation near the entrance of Trinity United Methodist Church. A new, square-shaped structure was constructed and that is connected to the original church building. **(SHAPE)**
- Between 2002 and 2013 (possibly during the renovation), several sections of parking lots were cleared out. Those former sections were replaced with a grassy area near the renovated church entrance. **(PATTERN)**
- The renovated section in the 2013 image does not appear to give off much shadows. This indicates that it is shorter compared to the original church structure. **(SHADOWS)**



Taken February 1, 2002
Before the entrance
renovation



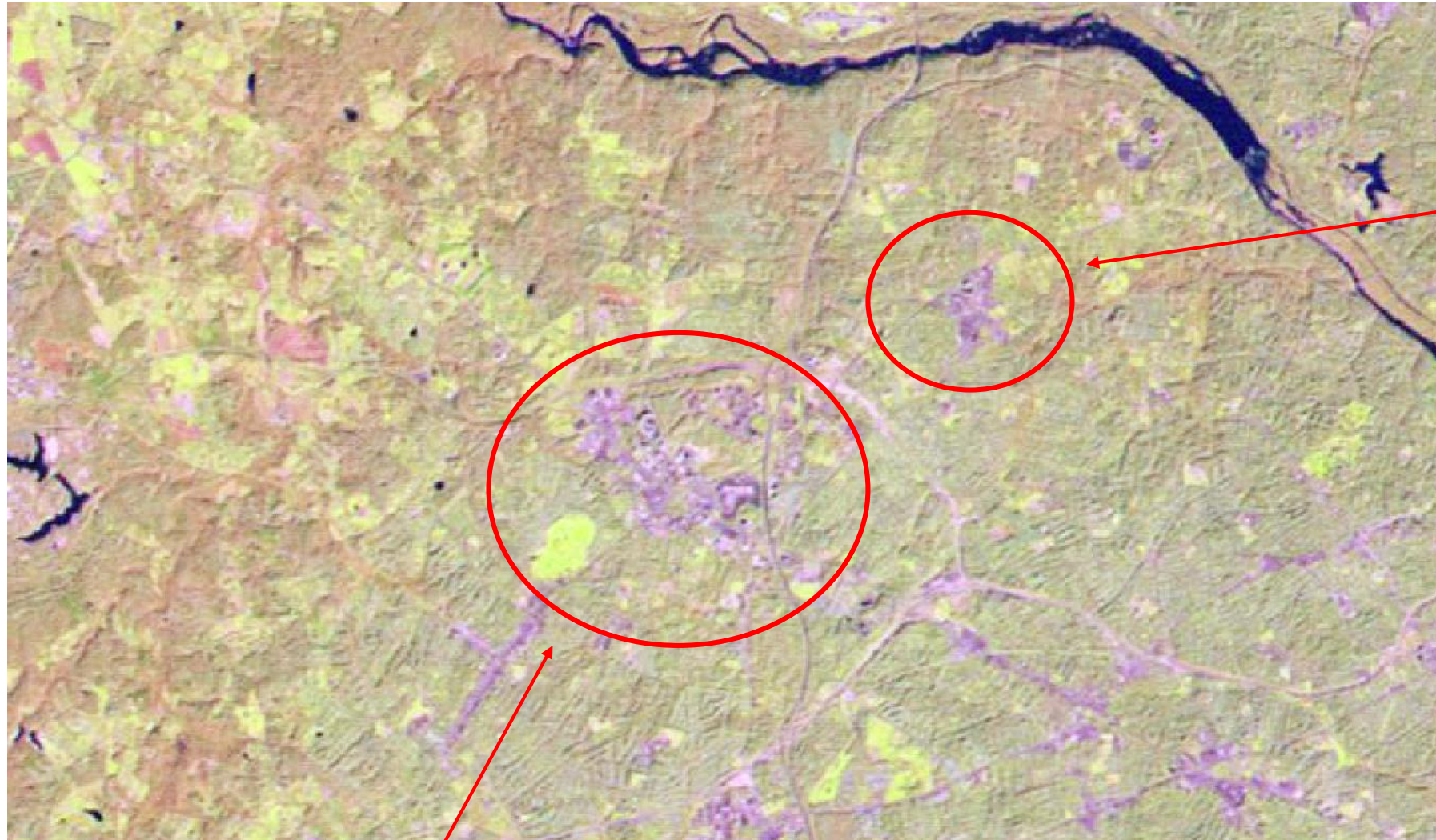
Taken February 14, 2013
After the entrance
renovation

Ground Photos



A photo of Trinity United Methodist Church (located in McLean, Virginia) as of April 13, 2018. The renovated extension of the church can be seen at the right half of the photograph, which is connected to the original church building on the left.

McLean/Tysons Corner from above

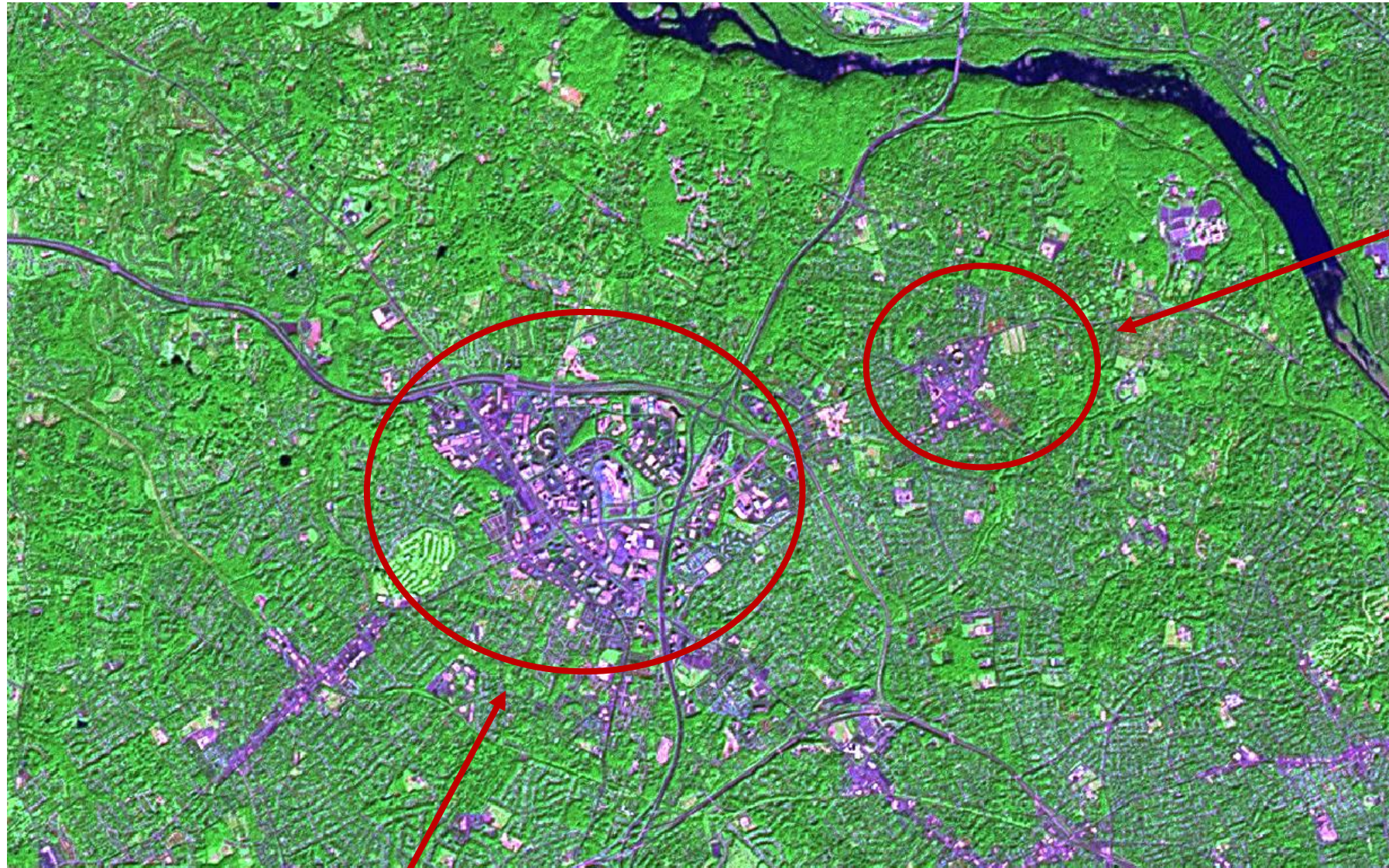


McLean, Virginia

Tysons Corner, Virginia

Landsat (TM Film Only)
Mclean/Tysons Corner, Virginia
Taken November 2, 1982

McLean/Tysons Corner from above



McLean, Virginia

Tysons Corner, Virginia

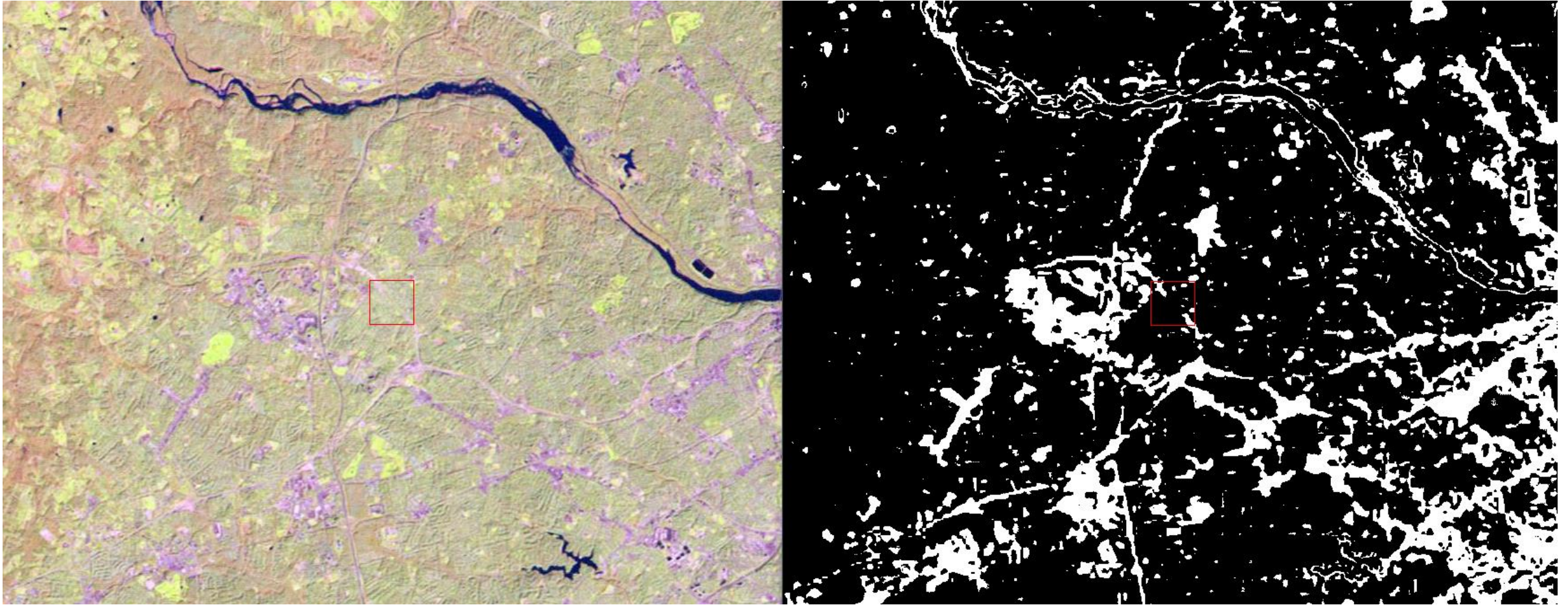
Landsat (ETM+ Pan)
Mclean/Tysons Corner, Virginia
Taken October 5, 2001

McLean/Tysons Corner: What has changed?

Based on the shape and size of McLean, Virginia within the two Landsat images, there hasn't been any dramatic trends in urbanization that would make the city expand in area.

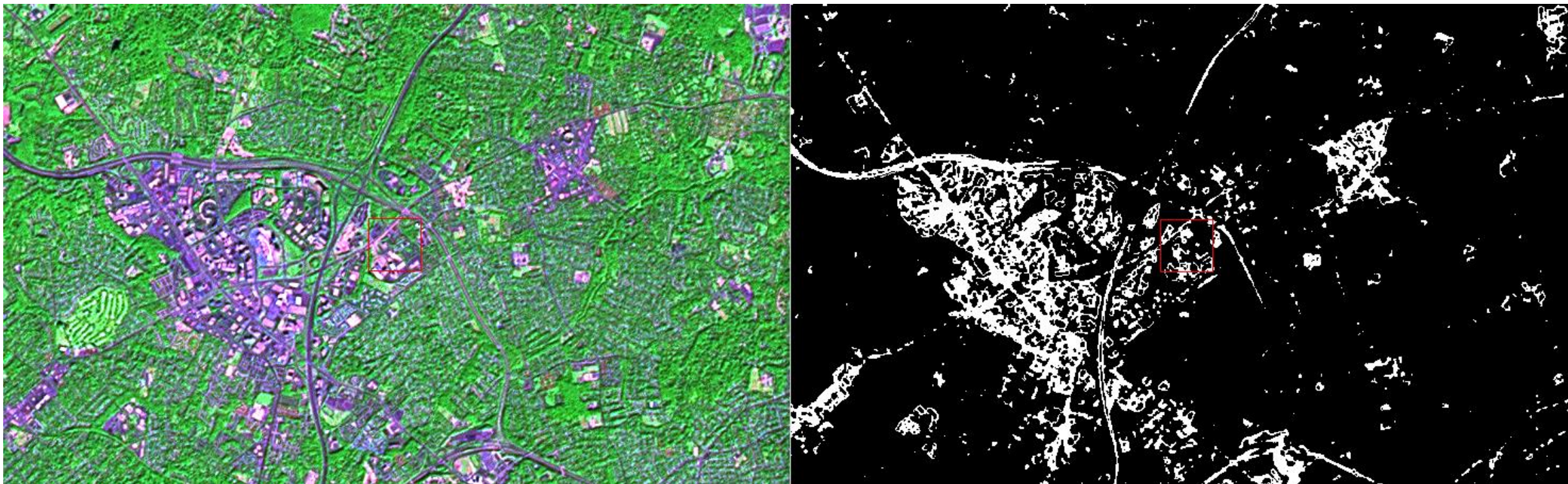
However, there have been more noticeable changes in the neighboring city of Tysons Corner, Virginia. Between the 1982 Landsat image and the 2001 Landsat image, we can see that significant urbanization has taken place over there. This is based on the fact that we can see changes in size and pattern within that location. This suggests that there has been the renovation and construction of new structures between the 1982 and 2001 Landsat image. This is in contrast with downtown McLean which has maintained a similar size as it did in 1982.

Spectral Angle Mapper Classification



Landsat (TM Film Only)
Mclean/Tysons Corner, Virginia
Taken November 2, 1982

Spectral Angle Mapper Classification



Landsat (ETM+ Pan)
Mclean/Tysons Corner, Virginia
Taken October 5, 2001

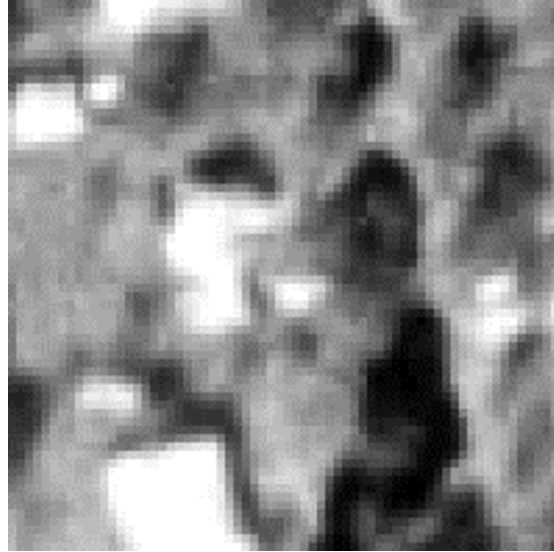
Spectral Angle Mapper Classification

The previous two slides demonstrate how Spectral Angle Mapper (SAM) Classification can be used on Landsat images. Link Displays was used as the original image was placed alongside the classified image for visual comparison. I used SAM to classify urban centers within the images (i.e. the grey areas within the original Landsat images). While there are likely some slight accuracy issues, I nonetheless felt that ENVI did a reasonable job classifying urban centers within these two images.

How has my house changed over the past several decades



Aerial Photo Single Frames
Taken June 8, 1983
McLean, Virginia



DOQ (Black and White)
Taken April 8, 1988
McLean, Virginia



High Resolution Orthoimagery
Taken February 1, 2002
McLean, Virginia



High Resolution Orthoimagery
Taken February 14, 2012
McLean, Virginia

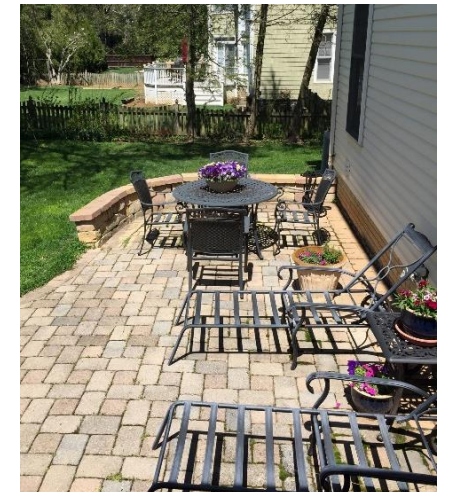
How has my house changed over the past several decades

In the first three images (1983, 1988, 2002), we can see the original structure that used to be my house. However, around 2003 that house was demolished and a new one was constructed, which can be seen in the 2013 image. Several photo-interpretation elements demonstrate that major changes have taken place at this location over the timespan of a decade:

- The house in the 2002 image is smaller and narrower than the house in the 2013 image. **(SIZE)**
- From a vertical view, the house in the 2013 image is relatively square-shaped, while the house in the 2002 image has a more irregular and asymmetrical shape. **(SHAPE)**
- The shadows emerging from the house in the 2013 image are noticeably larger than the shadows in the 2002 image. This possibly indicates that the newer house is taller than the old house. **(SHADOWS)**
- Although the driveway in the 2002 image is hidden by trees, there are cars arranged at opposite ends in 2002 and 2013. This indicates that a newer driveway was constructed and relocated. We can also see that the house in the 2013 image has a patio, while the house in the 2002 image did not. **(PATTERN)**



Old Driveway



Conclusion/Reflection

This assignment allowed me to apply various photo-interpretation elements (shape, size, tone, texture, shadows, association, etc.) to images of McLean, Virginia. These elements helped me understand how to detect change within a series of photos taken at the same location. These changes range from the construction of a new building, to the simple relocation of a driveway.

I was also able to apply classification within an image (specifically Landsat). This was a process of trial-and-error for me until I created a satisfying result. My original plan was to declare several regions of interest (i.e. trees, water, buildings) and use some form of supervised classification. However, I decided instead to use Spectral Angle Mapping (SAM) classification to highlight urban centers in the image (which were colored white). Through using SAM classification, I received a relatively accurate and satisfying result.

In conclusion, this project allowed me to take what I have learned regarding image analysis and apply it to data of my own choosing.