Personal Statement:

Every since I was little numbers were always intriguing to me. Every time my mom would drive the car, I would look at the billboards and notice the phone numbers. When I saw the phone number I would try and see if it was possible if the three digits could equal the last four digits by adding or subtracting the numbers. I always wanted to see if there was a a pattern with numbers because it seemed systematic. When I grew older, I would use multiplication or division to see if I could distinguish a pattern with the first three numbers equaling the last four numbers. This curiosity help create my fascination with mathematics. The reason is that you could do so much with numbers, which is why math felt so exciting.

Yet, living in a single parent household, I did not have a lot of financial resources to help me. However, that did not stop me and even though, the lack of financial resources, I found other means, like I enrolled in a summer engineering outreach program called Pre-Freshman Engineering Program (PREP) at New Mexico State University. As a middle and high school student I spent three summers learning about math, science, and engineering. PREP helped give me the resources that I could not afford and I took every advantage to learn more.

PREP helped me in choosing electrical engineering as my major in college. After taking several electrical engineering classes, it wasn't until I had taken my first signals and systems class that I knew I wanted to specialize in digital signal processing. The thought of convolution seemed fascinating and I was committed to mastering it. After learning about convolution, I started to go ahead and learn more about digital signal processing on my own. Digital signal processing combined my interest in mathematics and my fascination of electrical engineering into one. Then, when I took the second signals and systems class, I knew for sure I wanted to learn more about digital signal processing. During that time, I talked to one of the signal processing professors, Dr. Laura Boucheron and told her my interest in research. The next day Dr. Boucheron offered me a research position in digital image processing, which I was ecstatic.

While conducting research, I was still managing my extracurricular activities with NMSU's IEEE and Eta Kappa Nu student societies. With IEEE, I was president and would get guest speakers such as employees from Sandia, Boeing, and Valero for the general meetings. I would let the student members know about potential scholarships, internships, and REUs to get them prepared. With Dr. Stochaj, we set up an extracurricular project where several multidisciplinary students are working on a cube satellite. Current activities are making trade studies, requirements, and performing simulations. With HKN, I would tutor numerous students in probability and signal processing. On certain occasions, I would set up review sessions to help the students before their exam with going step by step on how to approach some of the problems.

On the side, I help out with Dr. Stochaj with being a lead for command and data handling subsystem and a member for the communication subsystem in the University Nanosat Program where NMSU is creating a satellite that will function as a neutron detector. In addition, I program iOS apps for a placed called Studio G. The main reason is that I want to increase my proficiency in programming, so Studio G is a great place to expand my proficiency.

Previous Research:

Iowa State University (Summer 2011):

Iowa State University's SPIRE-EIT REU is a summer program where I learned about human computer interact. My work was improving a 3D simulation program about volcanoes. It consisted of improving the graphic fidelity and making sure the contents were valid from a geography standpoint. It was going to be a learning tool to teach undergraduate geology students the life cycle of a volcano. Having it as a visual tool would aid the student's understanding of it better because they can visually see how a volcano's life cycle starts and ends.

This research was conducted with two students from different universities and educational backgrounds. My colleagues were a physics and a computer science major. While, the PhD student that was assisting us was in the geology field. It was interesting collaborating with everyone because of the different backgrounds and perspectives.

I was able to learn more about object oriented coding, which was new to me because before all I knew was procedural programming. Plus, I got to learn about OpenGL and OpenSceneGraph, which was brand new to me before I . After this REU, I knew I wanted to go to graduate school because the spark of research ignited inside of me and I knew that I always wanted to learn more about everything. All of the work my group had done was submitted to the Geological Society of America conference where one of my colleagues presented the work.

Stanford University (Summer 2012):

At Stanford, I participated in the Army High Performance Computing Research Center program where I learned about high performance computing. My research experience was working on the Xbox Kinect for object classification. The main motive under this research was to see the capabilities of the Kinect. The reason is that depending on the capabilities, the Kinects could be used for many reasons. One specific example is that they could be put on small rovers and take them to places to scan for objects. Usually the sensors that do that are very expensive so having a Kinect would significantly reduce the cost.

We used an open source program to scan a set of 3D shapes. We put the point clouds of each shape into a library where each shape had its own 3D histograms. With object classification, we used two methods distance method and quadratic form distance. With each method, we would compare both methods and scan an unknown object and see what the unknown object's 3D histogram would resemble the most in the shape library. The one that had the least error when comparing all the shapes' histograms in the library would the shape that resembled the unknown object the most. At the end, the Kinect would be able to scan objects that could be modeled very well in the cartesian coordinate system. Objects that looked like cubes and rectangular prisms would be classified correctly with high accuracy. However, objects that looked like cylinders or spheres would have horrible accuracy due to how the Kinect would scan. Thus, objects that are not easy to be modeled in the Cartesian system would have horrible accuracy. Overall, the Kinect is pretty good for the price, but for complex scanning, it still needs improvements. Thus, the Kinect would not be ideal if the army wanted to use them for robots maneuvering around detecting objects, just like the turtlebot. At the end of this program we made a 10 minute presentation to the Army.

Undergraduate research at New Mexico State University: (Feb. 2012- present):

Under Dr. Laura Boucheron, I conduct interdisciplinary research at my university. My research is to utilize digital image processing methods using astronomical data. The astronomical data is solar images of the chromosphere that are taken in the hydrogen-alpha wavelength. Using these solar images of the H-alpha wavelength, the first part is to deblur the images. The solar images came from the ISOON telescope which is ground based. Ground based telescopes are known to be exposed by atmospheric turbulence so the resulting images are known to be degraded.

For my part, I looked into how to use blind deconvolution to see how I could improve the quality of the solar images. I applied the blind deconvolution by using the Lucy-Richardson algorithm that iteratively restores the image and point spread function with using a variety of estimated Gaussian and disk point spread functions. The reason for the variety of Gaussian and disk point spread functions was because the atmospheric turbulence has been known to be modeled as a Gaussian distribution and if the lens was out-of-focus, a disk point spread function would be a good model. With using blind image quality metrics and using ten different dates from the solar data, an ideal point spread function would fluctuate from the dates since atmospheric turbulence can vary rapidly. A conference paper was written for Computer Vision and Pattern Recognition by November 1, 2013.

Now, I will be working on using support vector machines and relevance vector machines on the data to see if I can create a model to see how accurate to predict the next solar flare by using a balanced data set and using cross validation. When this section of research is completed, a journal paper will be sent to IEEE Transactions or a solar physics journal.

This work could provide predictive models that would beneficial to individuals concerned with space weather. For instance, the astronauts in the International Space Station would benefit because if a solar flare is erupting and with given enough time to prepare, they can prepare themselves from the solar radiation. The same thing for satellites since the radiation can degrade or destroy the electrical components, which results in mission failure for the satellites.

Future Goals:

My academic goal is to pursue a PhD in electrical engineering specializing in digital image processing. Image processing is a fascination to me and it can be beneficial in numerous interdisciplinary fields, such as the astronomy field for which I have been helping with my undergraduate research work. After I complete my PhD, I would want to work with Sandia National Laboratory because I was fortunate enough to be offered two fellowships from Sandia where I would be dealing with image processing in Synthetic Aperture Radar.