Proposal

Objective:

The objective of the project is to do surveying of an area using neural networks. It would take an input of various 2D images of the area, then eventually output a 3D map of the photographed area.

The expected outcomes are that an algorithm can be created such that it can take pictures as input, and the output will be accurate to the actual terrain.

Justification:

This can be used in space where it is more difficult to conduct full surveys of the area, as it could be unsafe or impractical to survey the area manually. By using 2D pictures, it would be easier to survey the area for safe navigation by rovers and other things.

Description:

The work will be accomplished by using general adversarial networks. These will take a preprocessed image and feed it into a discriminator which will distinguish between real and generated pictures. A generator will train to fool this network. The image processing will be done in MATLAB using various image processing toolboxes to process the image into a usable data format for the neural network. MATLAB will also be used to create the neural network. To get a 2D image from a generator, it will be projected onto a 2D viewpoint, which will then be input into the network. The independent variable is the data input. The dependent variable is the map that is generated.

Limitations:

Another limitation is computing power. The computing power limits how many calculations can be done. This would limit how much training could be done, which would then limit the accuracy of the model. Without enough computing power, the model could take too long to train.   
Another limitation is the amount of time. Without enough time, the model would be unable to train further. This would limit the accuracy of the network.

Feasibility

* Currently available resources:
  + Personnel:
    - Mr. Writer
  + Equipment
    - Computing power
    - Training data
  + Supplies
    - None needed
  + Knowledge
    - Cursory knowledge of AI, linear algebra, multivariable calc, principal component analysis
* Needed
  + Personnel
    - None
  + Equipment
    - MATLAB
  + Supplies
    - None
  + Knowledge
    - MATLAB programming
    - Neural network creation
    - Image processing
    - Understanding of general adversarial networks
    - Training neural networks
    - Convolutional Neural networks
  + Budget
    - MATLAB Student license - $50
    - Total - $50
* Safety
  + Because the only resource being used is software and computers, there are no safety risks.
* Alternatives
  + Instead of using general adversarial networks, a different neural network approach could be used to achieve the same goal. The preprocessing could also be changed to change the data that is input, whether by adding more information, like predicting the depth in the picture, or by changing how the data is input into the network.