Work Term Report Proposal:

GPR Features Classifier

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Summary:
One of the commonly most challenging and error-prone aspects of ground penetrating radar (GPR) solutions is the interpretation of GPR data. Hence, developing a machine learning image classifier would aid in this process.

Objective:
To develop a tool that would guide users in their interpretation of GPR data, with identifying hyperbolas as the main goal. The expected behavior of the classifier is to frame GPR features from an inputted image, as well as classify and label a percentage representing the likelihood of the feature.

This work term report will go into an exploration, comparison and analysis of different existing classifying models. The methods of learning and tradeoff between ease of training, transferability of application, as well as accuracy will be the main aspects of comparison of the models. The one with the highest chance of success will be implemented and refined with transfer learning for hyperbola detection, as a proof of concept.

The following pre-trained models will be compared:

- Inception V3
- MobileNet
- VGG

The pre-trained images of these models are readily available on ImageNet or Gradient Zoo. The models themselves can be implemented with Keras, a high-level machine learning API and Tensorflow wrapper for Python. The choice of models is subject to change as the research phase progresses.

As an extension of this project, the classification of more features, namely metal ringing, and air waves, could be implemented as the project progresses.

Additional Required Materials:
Pre-trained models significantly lower the amount of data needed to retrain and fine-tune, thus a minimum of 500 images per feature of interest (i.e. hyperbolas) is recommended. Based on previous experience, reasonable detection and classification accuracy was obtained using around 300 pictures, trained with the Inception V3 model.

Proposed Timeline:

Research Phase and Comparison of models:	Friday, July 6th
Implementation of model:	Friday, July 27th
Report Draft Completion:	Friday, August 3rd
Final Report Submission:	Friday, August 10th