**CS499 Spring 2018 - Neural Nets for Games Project**

**Developing Card Recognition Model**

* Environments developed in
  + Linux, Mac OSX, Google Cloud’s UNIX shell
* **Useful Tools and Links:**
  + [**http://www.bricelam.net/ImageResizer/**](http://www.bricelam.net/ImageResizer/): a tool for resizing images on Windows machines so that the images are not too large such as a 4000x3000 resolution image
  + [**https://github.com/tzutalin/labelImg**](https://github.com/tzutalin/labelImg): a useful annotation tool for labeling where cards are in images
  + [**https://github.com/tensorflow/models/blob/master/research/object\_detection/g3doc/running\_pets.md**](https://github.com/tensorflow/models/blob/master/research/object_detection/g3doc/running_pets.md): the primary tutorial which we used as a reference for how to develop a card recognition model. This is the best place to start and offers a great beginning experience for working with tensorflow. Our dataset can be used in essentially the same way as the running\_pets tutorial just by using a few different files (files labelled with card instead of pets).
  + [**https://github.com/Awallky/model\_server\_tree.git**](https://github.com/Awallky/model_server_tree.git): A Github repository ready to be deployed after cloning to a local machine. On simply needs to provide a model (.pb file extension) in the test\_ckpt/ directory to have it run correctly. One can also change the data/card\_label\_map.pbtxt
* **Necessary modules**
  + [**https://github.com/donaldvenus/models.git**](https://github.com/donaldvenus/models.git)
    - A link to the directory tree / Github repository which has been used to develop the card recognition model. This is a branch of the Tensorflow models directory and its object detection api which we use for the development of our model.
  + **Files of interest**, i.e. files developed by the team
    - **annotationdump.txt**: contains a dump of files that the Google Cloud servers could not locate during training requests. This has been addressed by the team and most of the missing files have been fixed/added to the data set. When using smaller datasets (such as the bicycle\_only\_images folder, this will contain a large number of files but does not indicate an error)
    - **Cloud\_submit.txt**: a file containing the commands used to submit training and evaluation requests to the Google Cloud servers. It also contains the command for creating the frozen model (has a .pb file extension). These will need to be altered to fit the directories in question.
    - **In the models/scripts directory, there are two python scripts**, which were developed in the early stages of the project, for renaming some segments in the annotations/label and for modifying images in the data set.
    - **In models/object\_detection/data/, there is a file called card\_label\_map.pbtxt** which is used as a dictionary containing all of the possible recognizable cards in the model’s data set. Use this instead of the pets\_label\_map.pbtxt to use the card dataset when working through the running\_pets tutorial.
    - **In models/object\_detection/samples/, there are several configuration files** for specifying model training settings such as batch size, i.e. the number of samples trained on at a time.
      * **models/object\_detection/samples/configs/faster\_rcnn\_resnet101\_cards.config** contains the configuration settings used for training on the card images. This was the first configuration file used but there are now many. Each file contains a description at the top that includes what was changed from the faster\_rcnn\_resnet101\_pets.config used in the running\_pets tutorial.
      * **models/object\_detection/samples/cloud/cloud.yml** contains the configuration settings for running the training and evaluation jobs on the Google Cloud Platform.
    - **In models/object\_detection/, the file create\_card\_tf\_record.py** is used to generate the training and evaluation record files that are necessary for training and evaluating the performance of the model as it trains. This file can be used instead of create\_pet\_tf\_record.py in order to use the cards dataset instead of the pets dataset when running through the running\_pets tutorial.
  + [**https://github.com/cs499s18p20/cs499s18p20.github.io**](https://github.com/cs499s18p20/cs499s18p20.github.io): Github repository containing the project webpage source code along with the front end and back end source code for the web application.
    - **rest\_tflow\_v1\_2.sh**: a bash script used to reset the tensorflow models repository back to a version compatible with [this](https://github.com/tensorflow/models/blob/master/research/object_detection/g3doc/running_pets.md) tutorial.
    - **Euchre Website/**: a directory containing the front end HTML and Javascript files for the web application
      * **aboutus.html**: a page on the front end describing the group project and holding a link to the group’s project website
      * **howtouse.html**: an HTML page describing how to use the web application
      * **euchre.html**: a web page containing the project application
      * **main.js**: contains a few functions providing the interactive functionality of the web application’s front end
    - **AppIntegration/**: a directory containing the flask-based back end code
      * **Deploy\_server.py**: implements the top-level functionality of the back end flask-based server
      * **A text file describing the directory structure** for implementing the flask-based server
      * **visualization\_utils.py**: an updated version of the file with the same name in the models/object\_detection/utils/ directory. It has had an extra function added to it that is not in the original called get\_image\_cards
      * **templates/**: a directory containing the HTML templates for the front end files required by the flask framework and sent back to the front end of the application
      * **static/**: a directory containing css/, images/, js/, and webapp/ directories required for returning html pages to the front end

**Flask-based Server**

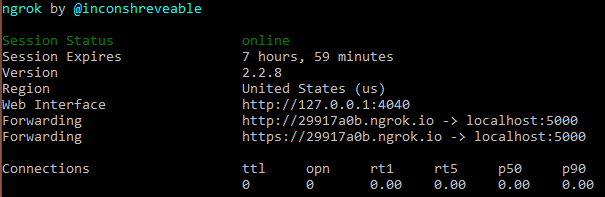
* Environments developed in: Mac OSX, Ubuntu 16.04
* How was it developed: Python 2.7, Python 3.6, JavaScript, HTML, CSS
* **Libraries used:**
  + **Tensorflow**: Google's open source object detection machine learning framework
  + **Flask**: An open source server side framework for useful for serving a Tensorflow model
  + **werkzeug**: Werkzeug is a WSGI utility library for Python. More can be found [here](http://werkzeug.pocoo.org/)
  + **base64**: This standard defines the Base16, Base32, and Base64 algorithms for encoding and decoding arbitrary binary strings into text strings that can be safely sent by email, used as parts of URLs, or included as part of an HTTP POST request. More can be found [here](https://docs.python.org/2/library/base64.html).
  + **numpy**: A powerful library for performing efficient linear algebra on matrices or lists.
  + **collections**: This module implements specialized container data types providing alternatives to Python’s general purpose built-in containers, dict, list, set, and tuple. More can be found [here](https://docs.python.org/2/library/collections.html).
  + **matplotlib**: A plotting library for the Python programming language and its numerical mathematics extension NumPy. More information on this library can be found [here](https://en.wikipedia.org/wiki/Matplotlib).
  + **PIL**: (aka pillow or Pillow) An image modification library. More information on it can be found [here](https://pillow.readthedocs.io/en/5.1.x/).
  + **threading**: A library used for multithreading.
* **How to test it:**
  + Set up the directory tree as described, and **from the models directory run the following commands:**
    - **protoc object\_detection/protos/\*.proto --python\_out=.**
    - **export PYTHONPATH=$PYTHONPATH:`pwd`:`pwd`/slim**
  + **Then change direct run python deploy\_server.py from a terminal.** You should see “Loading graph…” appear on the terminal. This means that the server is working correctly. You can then open a page to localhost:5000/aboutus to bring up the application on your local machine.
* **How to set up directory tree:** refer to DIRSTRUCTURE.txt under the [**cs499s18p20.github.io**](https://github.com/cs499s18p20/cs499s18p20.github.io)**/AppIntegration**/ directory.

**Developing Web Application**

* Environments developed in: Mac OSX, Ubuntu 16.04, Windows 10, Mozilla Firefox 59.0.2
* **How to test it:** Download the source code from the [cs499s18p20.github.io](https://github.com/cs499s18p20/cs499s18p20.github.io)/submitPage and [cs499s18p20.github.io](https://github.com/cs499s18p20/cs499s18p20.github.io)/Euchre Website directories. You can then run them locally from your web browser.

**Hosting Server**

* **What tools were used:** ngrok
* **What modules are needed:** the flask-based server
* **How to set it up to be publicly available**: open a terminal and change directories to where you have the ngrok application located. Make sure you can run the server on your local machine, as described above, and then type **./ngrok http 5000**. You will then see something similar to this in your terminal window:



From this example, the web application’s address sits at <http://29917a0b.ngrok.io>/aboutus. You should now be able to host the server publicly.