Assignment 7 - Deep Learning

To be completed: **As a team**
Due date/time: **Fri Apr 21, 5:00pm** via Blackboard
Deliverables: **Final report**, handed in via Blackboard, plus **in-person presentation on Apr 27**

You have two options in this final project assignment:

1. A suggested project, which related to deep learning
2. A project that explores some other machine learning method that you find interesting

For either option, you should use your dataset that you have been collecting, ideally having collected at least 1000 examples of your own data (before splitting into train/validation/test). You may choose to augment your own data with additional datasets (e.g. standard ML datasets), but you must include results on just your data, versus your data plus additional data.

Report: Please prepare a written PDF report (~4-6 pages) that summarizes your dataset (to a reader unfamiliar with your previous projects) as well as the work you do for the final project. You may include interesting results from previous assignments as well. (Assume that the reader is encountering your work for the first time in this current report.) Present whatever results and figures are necessary and useful to communicate what you have done.

Presentation: Please prepare an **8 minute** presentation of your project. *This time limit will be strictly enforced.* Your presentation should include a description of your dataset and why you think it is an interesting ML problem. You may include interesting results from previous assignments as well. The rubric used to grade the presentation can be found on page 3 of this assignment. You can use the whiteboard, handouts, and/or Powerpoint. *If Powerpoint, then your slides should be emailed to me (mkunda@vanderbilt.edu) no later than April 26th.*

Option 1: Suggested project

As we discussed in class, a now-common approach in deep learning is to take a pre-trained deep network (so all the intermediate layer features have already been learned on one task), and then re-train the last layers of the network on a new task (essentially reusing the same features but now on a different task).

For the final project in this course, you will use this method to train on your own dataset. You can use any machine learning package that supports this; we recommend TensorFlow, and the Inception neural network architecture, pre-trained for image classification, which you can re-use on your own image classification task. (See how-to resources on page 2 of this assignment.)

Option 2: Different project

Choose some machine learning approach that interests you to try out with your dataset. You may write your own code, or you may use existing machine learning toolboxes (e.g. TensorFlow, etc.) The same requirements regarding the project report apply.

Resources for TensorFlow and using pre-trained Inception neural nets for transfer learning

- TensorFlow official website:
  - https://www.tensorflow.org/
- TensorFlow installation:
  - https://www.tensorflow.org/install/
  - For Mac and Linux, we recommend using virtualenv to install.
  - For Windows we recommend using anaconda.
  - We have been using v0.12.1 with no issues. v1.0 may have some issues for the transfer learning code.
  - If you are using PyCharm as your Python IDE, you can use its great python library management tool to easily upgrade or downgrade TensorFlow to a certain version.
- Code for transfer learning (using pre-trained Inception v3):
  - https://github.com/tensorflow/tensorflow/blob/master/tensorflow/examples/image_retraining/retrain.py
  - The code does two things: 1) download the pre-trained Inception neural nets; 2) perform retraining with your own dataset and generate a new neural network.
- Code for applying the retrained neural nets to classify new images:
  - https://github.com/llSourcell/tensorflow_image_classifier/blob/master/src/label_image.py
- Some other useful resources:
  - Google's "How to Retrain Inception's Final Layer for New Categories":
    - https://www.tensorflow.org/tutorials/image_retraining
  - Google's "TensorFlow for poets":
    - https://codelabs.developers.google.com/codelabs/tensorflow-for-poets/#0

Presentation Rubric

	Score: 4	Score: 3	Score: 2	Score: 1
Content	Showed evidence of solid scholarship and presented new information. The class learned something new and valuable.	Conducted some scholarship and presented general knowledge. Moderate learning opportunity for the class.	Little evidence of scholarship. Presented claims without adequate support. Limited learning in the class.	No evidence of scholarship, and/or presented information that is inaccurate or irrelevant. Made the presentation from existing knowledge. Little benefit for class.
Organization	Followed a logical sequence and told a coherent, interesting story.	Followed a mostly logical sequence. More or less information would have been helpful, or lacks good transitions.	Information is inconsistently organized, and/or there is no introduction, transitions, or conclusion.	There is no sequence of information and/or the presentation makes little sense.
Visual Effectiveness	Visual aids are creative, clear, and visually engaging, and directly support the presentation.	Visual aids relate to presentation, but are somewhat cluttered or unclear and/or are not visually engaging.	Visual aids only marginally relate to presentation and/or are visually very boring.	Visual aids do not relate to presentation, are overly cluttered, and/or contain too many or too few details. Little evidence of effort.
Presentation Style	Captured the audience with eye contact, body language, and clear voice. Well-prepared. Professional delivery.	Good eye contact, adequately prepared, acceptable delivery. Easy to hear and/or follow.	Little eye contact. Evidence of hurried preparation. Choppy delivery. Hard to hear and/or follow.	No eye contact. Unprepared. Very poor delivery. Very difficult to hear and/or follow.