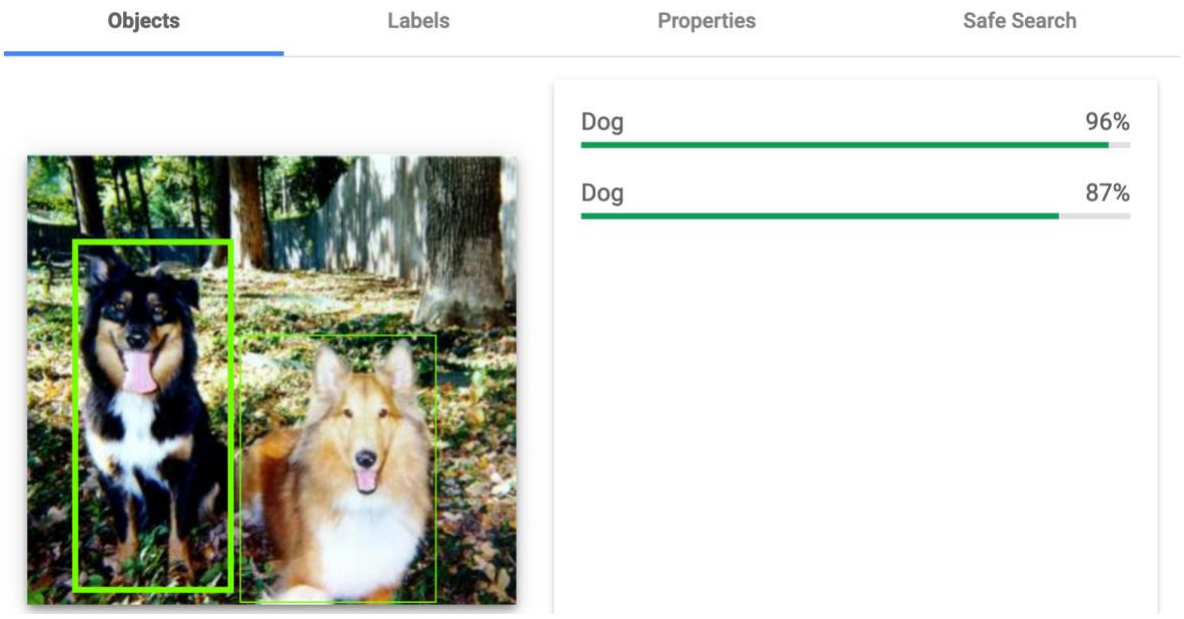
Washington State University
School of Electrical Engineering and Computer Science
Fall 2020

CptS 440/540 Artificial Intelligence
**Homework 12**
Due: December 10, 2020 (11:59pm pacific time)

**General Instructions**: Put your answers to the following problems into a PDF document and submit as an attachment under Content → Homework 12 for the course CptS 440 Pullman (all sections of CptS 440 and 540 are merged under the CptS 440 Pullman section) on the Blackboard Learn system by the above deadline. Note that you may submit multiple times, but we will only grade the most recent entry submitted before the deadline.

1. Given the Hidden Markov Model (HMM) for the [m] phoneme on slide 40 of the Natural Language lecture notes, compute the probability of each possible path through the HMM for the sequence of frame features $C_1$,$C_2$,$C_4$,$C_4$,$C_6$. Show your work.

2. Take a picture, or choose one from your own library (not one downloaded from the internet), and enter it into Google's image understanding API at https://cloud.google.com/vision. Try to use a picture with multiple objects and avoid single-person portraits. Show a screen capture of the "Objects" result and identify at least one object it identified in your image and at least one object it did not identify. For example, below is the Google Vision results for an image of two dogs (no, you can't use this image). It correctly identified the two dogs, but did not include the grass, leaves, trees, fence, or bench .



3. Enter your same picture from problem 2 into the MIT Places Demo at http://places2.csail.mit.edu/demo.html. Show a screen capture of the result. Comment on whether or not the Scene Categories are correct. For example, below is the result for my picture. No, this is not a "cemetery", but "botanical garden" is close.

**Predictions**:

- **Type of environment:** outdoor
- **Scene categories:** cemetery (0.170), botanical_garden (0.140)
- **Scene attributes:** no horizon, natural light, vegetation, open area, foliage, leaves, man-made, trees, natural
- **Informative region for predicting the category "cemetery" is:**

4. Recall the "deepfake" video shown at the end of the Vision lecture on December 3rd. Describe an ethical issue concerning the use of this technology and describe an example of this unethical use.

*There is no CptS 540 only problem for this homework.*