

ENGS 108 Fall 2022 Assignment 1
Due September 15, 2022 at 11:59PM on Canvas
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1. Go to

<https://www.kaggle.com/datasets/coloradokb/dandelionimages>

and download the dandelion and other images.

- (a) Define a reasonable distance metric between images and explain it with an example.
- (b) Which two images are most similar according to your metric?
- (c) Which two images are most different according to your metric?
- (d) What dandelion image is the most representative of the dandelion images?
- (e) Which other image is most representative of the other images?
- (f) What dandelion image and other image are closest to each other?

2. Define

$$f(x_1, x_2, \dots, x_5) = \frac{1}{1 + e^{-2x_1 - 3x_2 - 4x_3 - 5x_4 - 6x_5}}.$$

(a) What is

$$\frac{\partial f}{\partial x_i}?$$

(b) What is

$$\nabla f(1, 0, 0, 0, 0) \cdot \text{ones}(5, 1)?$$

(c) What is

$$\nabla f(0, 1, 0, 0, 0) \cdot \text{ones}(5, 1)?$$

3. Some Tesla batteries have an amp hour rating of 230 but in tests, it has been determined that the actual amp hours of a new battery is a random variable uniformly distributed between 230 and 250 amp hours. (Tesla is conservative in reporting this.)

- (a) A Tesla service center is shipped 5 randomly selected batteries. What is the probability that exactly 2 of the 5 batteries have less than 235 amp hours?
- (b) Your Tesla battery is being replaced at that service center. The service center does not measure the amp hours of batteries it receives or installs. What is the probability that the smallest amp hours of the 5 batteries is below 235?
- (c) What is the probability that your Tesla gets the battery with the lowest amp hours?