

Math: Shapes and Colors

Problem

Alice loves shapes. Among all shapes, she loves circles and squares the most. Alice wants to know the color of each shape she owns.

Unfortunately, Alice sees colors in a very peculiar way — she can see ultraviolet and infrared spectrums, but cannot distinguish normal colors.



Today, Alice received 200 shapes: 100 circles and 100 squares.

Each shape is painted in a color:

- all 100 circles are painted green,
- 10 squares are painted green,
- 90 squares are painted yellow.

Alice built a classifier to predict the color of each shape based on the form of this shape.

Classifier — an algorithm that predicts the class of an object based on its features. In this case, the classifier predicts the color of a shape given the form of the shape (circle or square).

Alice's classifier is the best possible classifier for this task.

Unfortunately, even the best classifier sometimes makes mistakes...

Your task is to find the misclassification error.

Misclassification error — the probability of misclassifying an object chosen at random (for example, you predicted a yellow color while it's actually green).

Task {1}: compute the misclassification error.

Now, Alice has realized that she actually loves circles more than squares. In fact, she loves circles three times as much as squares.

Therefore, she builds a new classifier that is more careful when classifying the colors of circles.

She tried to build a new classifier, and interestingly enough, her new classifier turned out to be the same as the previous one.

Now, she wants to know the weighted misclassification error of her classifier.

Weighted misclassification error — the probability of misclassifying an object chosen at random, where each object is weighted by its importance. The total error is the sum of misclassified weights divided by the total weight.

Given weights of 3 for circles and 1 for squares, find the weighted misclassification error.

Task {2}: find the weighted misclassification error.

Hint

If you aren't comfortable with the concept of a classifier, you can check out this video by Google for Developers on classification: <https://youtu.be/QM0sYbEQSkM> (keep in mind that our classification error is calculated based on the prior — given features of an object, while classification errors mentioned in the video are calculated from the posterior — the class of an object which the classifier predicts).

Format

For this task, you only need to submit two numbers for tasks {1} and {2}. A solution is not needed.

Grading

- 50% for correct task {1}
- 50% for correct task {2}