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Deliverable 1

1. Project

The project will be a program that detects hand signs via a camera, with which the user will be able to draw shapes. Each sign will correspond to a basic shape (oval, rectangle, triangle, line). The program will detect the hand sign (and thus the shape to draw), as well as datapoints concerning the hand position, from which to infer the shape's size (regression model). Some signs will allow the user to move the last-drawn shape on the canvas, or to delete the last-drawn shape.

2. Dataset

The dataset that will be used for the hand signs is the following: ASL Alphabet | Kaggle. This dataset includes pictures of ASL hand signs in different lightings and conditions.

3. Methodology

   a. Data preprocessing

   The database images will be used directly. They represent well the quality of the images that the program will be dealing with. However, only a few of the database categories will be used: one letter/category for each shape, plus two for moving a shape or deleting it.

   b. Machine learning model

   From the dataset images, the letter/category will be predicted. The machine learning models used will be the following: to detect hands, the mediapipe library will be used, it detects hands and also extracts 3D data; to recognize signs, the random forest classifier model will be used. These two models/libraries were the ones used in the LiveSigns 2021 MAIS hacks project, which resembles this project very much for the hand detection and sign recognition part.

   For the shape regression, a linear regression model such as gradient descent will be used. This model will have to function for the four kinds of shapes used: an ellipse, a rectangle, a triangle, and a line. The rectangle and triangle will be special implementations of the line in which three or four lines will be connected (with right angles for the rectangle).

   c. Evaluation metric

   The evaluation metrics will include the accuracy of the hand sign detection and the precision of the drawing with respect to the hand movement.

4. Application/final conceptualization

   The project would be featured in a webapp in which users could draw on a canvas. A possible implementation would be a game in which a drawing is shown, and the user must replicate that drawing using the program.