The key point of the algorithm is to detect and compare how different parts of the signature stroke are drawn. In order to properly break the signature into segments parts, a new corner detector is defined as shown below-

2.1 Preprocessing

2.1.1 Removing noise

The dataset contains some strokes that consist only of a single point. A single point is just a dot on sketch and is incapable of representing lines or corners. Hence such strokes are removed before the algorithm checks for presence of corners in a stroke.

2.1.2 Resampling

Resampling of strokes is done to remove noise to avoid detecting extra corners. While resampling, same changes are made in the strokes like refining wavy lines to straight lines and redrawing curves with proper curvature. To record a stroke, the position of pen is recorded repeatedly after a fixed duration of time. Since different parts of sketch are drawn at different speeds, these points are not equidistant. The algorithm preprocesses the strokes so the all the points on the stroke are at the same distance. This is done as-

* If the distance of next point p2 from the current point p1 is very small, Ignore the next point p2 and move to the point next to p2
* If the distance is more than the threshold t -

1. Find the vector v in the direction of current point to the next point as

v = position of next point - position of current point

1. divide v by its magnitude to make it a unit vector
2. make a new point p at a distance t from the current point in direction v
3. make p as the current point and p2 stays as the next point

2.2 Algorithm

As discussed above, the algorithm simulates driving a car in high speed on a road in the shape of the stroke and detect collisions as corners. The major steps of the algorithm is as under.

2.2.1 Step 1: Defining the car

The car is defines by 2 parameters -

1. speed

2. maximum steering angle

2.2.2 Step 2 :Getting the direction of the road

The algorithm defines the direction of the road using the direction of a vector pointing from a point n points behind the current position of car to the current position of the car. This is also the distance the car will move in 1 unit time.

2.2.3 Step 3: Predicting the position of the car after 1 unit time

assuming straight road The direction found in step 2 is used to predicts the position of a point n points ahead of the current position assuming that the car is driving on a straight road.

2.2.4 Step 4: Detecting curvature of road

After the prediction, the angle between the predicted point and actual point is calculated. This is the angle that the car needs to steer in order to avoid collision.

2.2.5 Step 5: Checking for corner

If the above angle is more than the maximum steering angle of the car, the current point is marked as a corner point.

2.2.6 Understanding the car parameters

This value n used in step 2 is the speed of the car as if we take a larger value of n (i.e., the car is moving at a higher speed) then the algorithm will be predicting a point that is even farther away from the current point. Hence the chances of error will be larger. In are simulation, it can be explained as a car moving in a higher speed, higher the speed, harder it will be to change the car's direction. Hence, the speed of the car n and the maximum steering angle are the two parameters that define the sensitivity of the algorithm towards corners.

3. Extracting Features from Segments:

After breaking the signature into segments, some features are saved from each of these segments. We then use these features to compare two signatures.

The detected features are as under:

1. number of segments
2. average speed of each segment
3. ratio of sum of angles in the segment and sum of absolute angles in the segment

In above features, feature 2 and 3 are arrays that store information for each segment. Hence, these are only 2 features but the amount of information they extract from the stroke is much higher.

We also use ratio of sum of angles and sum of absolute angles in the whole signature as it can combine with feature 3 above to give proper insight of how the signature is drawn.