**A Robust Offline Handwritten Signature Verification System Using Writer Independent Approach (Kumar,2017)**

**Model:**

* The paper used a dissimilar-based approach that trains the classifier with positive (genuine) and negative (forger) samples. Positive and negative samples are generated by computing the dissimilarity vector among genuine samples. The computed dissimilarity vectors are used to train two classifiers, two models of ANN and one model of SVM. The result shows that the SVM achieved higher results than the ANN model.

**Evaluation Metrics**

* The performance of handwritten signature verification system is measured in terms of False Rejection Rate (FRR) and False Acceptance Rate (FAR).
* The FRR, also known as type I error, is the percentage of genuine signatures rejected as false.  
  The FAR, also known as type II error, is the percentage of forgery signatures accepted as genuine.
* Several researchers have considered Average Error Rate (AER) which is the average of FFR and FAR.

**Types of OfSV according to author:**

* Writer dependent (WD) and writer independent (WI) are two approaches of offline signature verification systems.
* In writer dependent approach, a personal model is built for each writer. The writer dependent has two major issues, first, it requires large sample of genuine signature images and second, it is not scalable as each writer needs to have its own separate model.
* On the other hand, writer independent approach, also called global model, requires only one for all the writers which makes it easy to scale up the number of writers in the model.

**Pre-processing:**

* Median Filter is used to remove the noise from the image.
* Binarization was performed using the Otsu’s method.
* The signature image is cropped and resized to the image size 256 x 512.

**Feature Extraction:  
Geometric Feature Vector -** Ten global features are extracted from the signature images namely

1. signature area
2. mean
3. standard deviation
4. number of connected components
5. perimeter of signature image
6. number of horizontal edges
7. number of vertical edges
8. number of edge points
9. number of horizontal
10. number of vertical lines

For the local features, divide the signature image into four equal parts and extract the same 10 features mentioned earlier. Thus, 10 global and 40 local features are extracted to form the geometric feature vector.