COMPSIG NITT

In This Issue...

- **Reader's Space:** Improvement of Classification Techniques Using Support Vector Machine and Randomized Decision Rule.
- **On-going research work:** Current research works done in pattern recognition and computational intelligence laboratory.

Dear friends! COMPSIG NITT is a monthly newsletter to share the research work done in the Pattern recognition and computational intelligence laboratory, Department of Electronics and Communication Engineering, National Institute of Technology Trichy.

Concepts, Ideas pertaining to Computational intelligence, Pattern recognition and Signal processing are also included in this newsletter.

We expect the feedback, comments and articles from you all.

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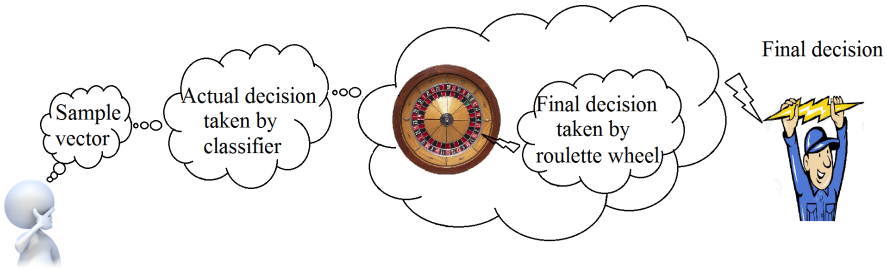
READER'S SPACE

A Support Vector Machine (SVM) is a discriminative classifier formally defined by a separating hyperplane. This project seeks to improve the classification rate (Percentage of Success) of SVM by appending it with Randomized Decision Rule Block. The Randomized Decision Rule is implemented using the Mini-Max Technique, where Mini-Max is a decision rule in decision theory for minimizing the possible loss for a worst case (maximum loss) scenario. To prove the proposed algorithm, a dataset containing 19 activities performed by 8 people was chosen from UCI Machine Learning Database. After preprocessing of input data, eighteen classifiers were constructed using the training data. Each classifier was modelled as a binary channel and its characteristics were determined. The Randomized SVM (RSVM) uses four decision rules as given below.

Rule 1 states that the decision of SVM is correct.
Rule 2 inverts the decision of SVM.
Rule 3 states that decision of RSVM is true irrespective of decision of SVM.
Rule 4 states that decision of RSVM is false irrespective of decision of SVM.

Depending on the Mini Max graph obtained for the classifier , two of the above rules were employed. A Roulette Wheel was designed to choose one of the two rules. This Roulette wheel chose one of the two sectors of a circle with a certain probability which is fixed for a given classifier. This is the Random nature of the algorithm which helped in overturning the wrong decision of SVM. The figure below shows a pictorial representation of the operation of Roulette wheel which decides whether the decision of SVM is correct or not.



The Percentage of Success (POS) for each SVM is compared with the POS of RSVM. It is observed that the improvement in POS is more for classifiers which perform poorly. Classifiers having POS of 72% and 47% have been improved to 78% and 65% respectively. Classifiers having very poor POS of less than 10% have been increased to above 50% using the RSVM block. This algorithm can be implemented for classification of huge data sets by cascading all the classifiers.

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Back to Contents

ILLUSTRATION

Consider five independent source signals that are uniformly distributed (refer Fig. (a)). The summation of these five signals is given as the additive signal and the corresponding histogram is also given (refer Fig. (b)) . What do you infer?. If the rectanular pulse (X) (refer Fig.c) is treated as the probability density function (pdf) of the uniformly distributed random variable, interpret what are X_1, X_2 and X_3 ?. This demonstrates the usage of gaussianity measurement in signal processing.

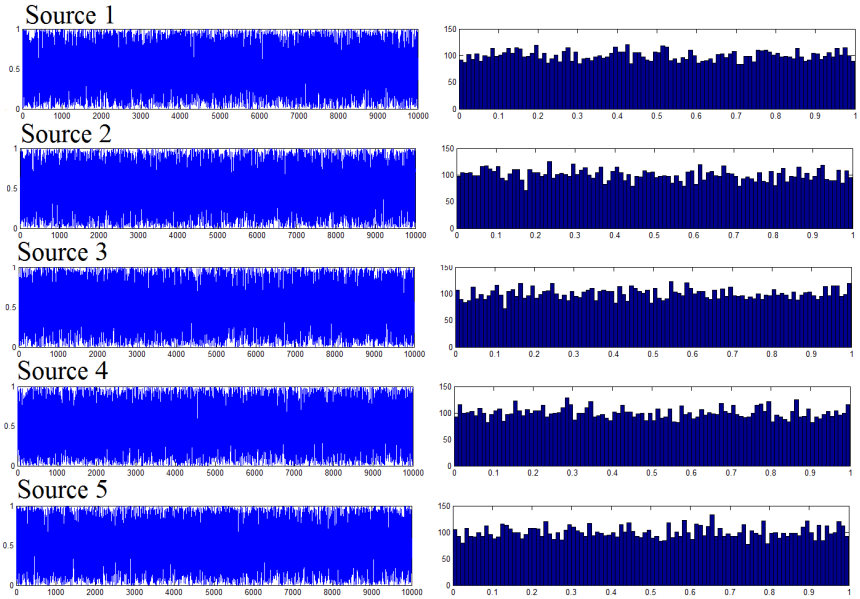


Fig.(a): Individual signals and their corresponding histograms

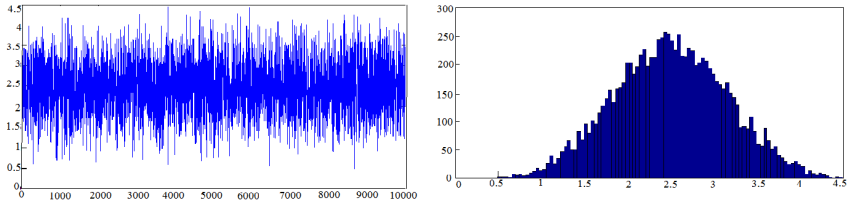
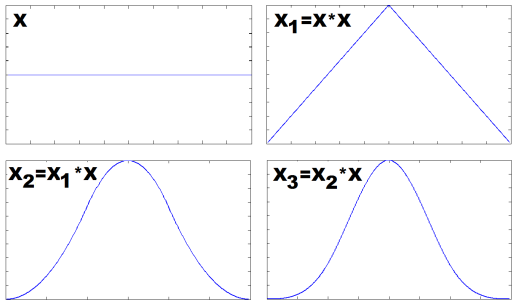


Fig.(b): Additive signal and its histogram

x axis - sample number
y axis - amplitude

Note:If the pdf of two independent random variables P and Q are $f_P(p)$ and $f_Q(q)$ respectively, then the pdf of the random variable $Z = P + Q$ is given as $f_Z(z) = f_P(z) * f_Q(z)$.



*** is the convolution operator**

Fig.(c)

Back to Contents

Quotes

> *"To become 'unique,' the challenge is to fight the hardest battle which anyone can imagine, until you reach your destination." —* Dr. A.P.J.Abdul Kalam

On going research work

- **Linear discrete system model to construct classifier for pattern recognition** The usage of classical DSP techniques like convolution, FIR/IIR filter, Pole-Zero representation are explored to construct a classifier that is helpful for big data analysis.
- **Discrimination of plants and weeds from RGB images** The objective is to identify and locate the position of the intended plant from the images that are captured by robot and perform discrimination of plants and weeds at an early stage.
- **Varietal identification of sunflower seeds** A database is created with 10 varieties of sunflower seeds consisting of minimum 70 samples in each group. Various techniques for feature extraction, dimensionality reduction and classification are being investigated for varietal identification of sunflower seeds.

Back to Contents

Feedback

COMPSIG NITTT invites articles and innovative ideas from readers for the Reader's Space column. We expect feedback and comments to monthly newsletter COMPSIG NITTT . A facebook group, "COMPSIGNITTT" is created for the readers to share their views. Those who are interested can send requests to the facebook group.

Back to Contents

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