

## In This Issue...

- **Reader's Space:** Music Tone Identification from Instrument Music by Samuel Cherukutty Cheruvathur, M.Tech, Communication systems.
- **Classifiers - An Analysis:** In the pattern recognition course, various classifiers were studied and analyzed through experiments by students.

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

It is always the dream of a music learner to get learn the notes of his/her favorite songs. It is very difficult for a beginner to find the note of his favorite tunes. This is the current scenario as only the expert musicians are able to perceive the tones played using the instruments. This project aims to bridge this gap by bringing in signal processing to understand the note of the keys played. The recorded music that is played using an instrument is filtered using a Gaussian filter of order 1. The filtered signal (Fig.1) is then analyzed for key presses and divided into segments (Fig.2) for further frequency analysis.

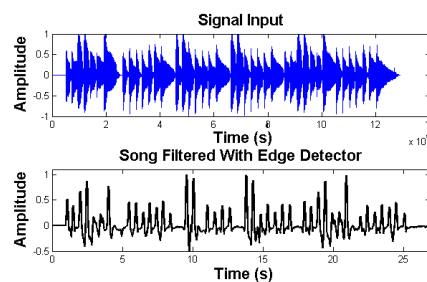


Fig. 1

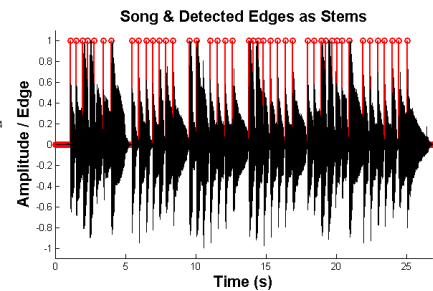


Fig. 2

Each segment's spectrum is analyzed for frequency detection (Fig.3). The harmonics occurring in each segment are considered and based on the individual amplitudes, tabulated in the results.

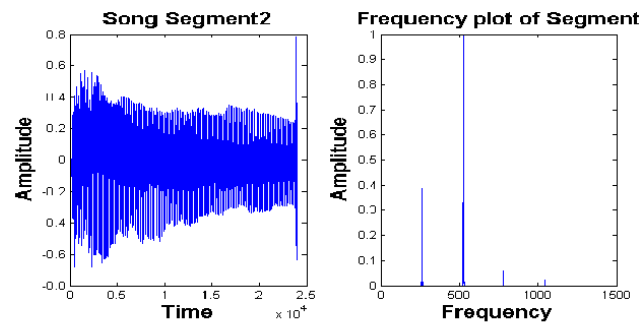


Fig. 3

|      |                       |
|------|-----------------------|
| 'C4' | 'quarter note'        |
| 'C4' | 'quarter note'        |
| 'G4' | 'eighth note'         |
| 'G4' | 'quarter note'        |
| 'G4' | 'dotted quarter note' |
| 'A4' | 'quarter note'        |
| 'G4' | 'dotted half note'    |
| 'F4' | 'quarter note'        |
| 'F4' | 'quarter note'        |
| 'E4' | 'quarter note'        |

Fig. 4

From the length of the segments formed, the durations of notes are calculated based on the histogram of occurrences of notes assuming the 'quarter note' to be the most occurring note in the whole tone. The frequency is converted to the note using the equation  $n = 12 \log_2(f/440) + 49$ . The notes with duration is obtained (Fig.4).

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## CLASSIFIERS - AN ANALYSIS

The classifiers were studied and analyzed through experiments on ORL face database. Sample face images of the particular class in ORL face database which is a challenge for pose is shown below.



**Multiclass Logistic Regression:** Logistic regression is a supervised classification technique in which the data belongs to the class that has highest probability of occurrence. The probability is predicted by fitting data to a logistic function.

**Support Vector Machine:** An SVM classifier is a non-probabilistic binary linear classifier. Kernels such as gaussian, polynomial can also be incorporated into SVM's for a better classification.

**K-Nearest Neighbors and K-Nearest Mean:** In K-NN classification, the output is a class membership with the object being assigned to the class most common among its k nearest neighbors. In K-NM classification, each observation belongs to the cluster with the nearest mean.

**Neural Networks:** Neural networks are generally presented as systems of interconnected "neurons". The connections have numeric weights that can be tuned based on experience, making neural nets adaptive to inputs.

| Classification Technique                | Name                  | Department | Percentage of Success |
|---|-----------------------|------------|-----------------------|
| Neural Network                          | Sri Vignesh PSS       | ECE        | 93                    |
|   | John Mathai           | ICE        |                       |
|   | Richard Einstein Doss | ECE        |                       |
|   | Ezhilvel              | MET        |                       |
|   | Nihal Narayanan       | CSE        | 92                    |
|   | Pranav Prakash        | ECE        |                       |
|   | Vignesh. M            | EEE        |                       |
|   | Anantha Natarajan     | MET        |                       |
|   | Vignesh. T            | ECE        |                       |
|   | Bragadeesh            | ECE        |                       |
|   | Vignesh. K            | ECE        |                       |
|   | Abi Joseph            | ECE        |                       |
|   | Shravan               | MECH       | 92.5                  |
|   | Vivekanandan          | MECH       | 91                    |
|   | Ajay Prasad           | CSE        |                       |
|   | A. Adithya            | ECE        | 85.5                  |
| K- Nearest Neighbor                     | Sohel Haque           | EEE        | 60                    |
|   | Lavanya Preethi       | EEE        |                       |
|   | Pavithra              | EEE        |                       |
|   | Kauviya               | EEE        |                       |
|   | Vivek Kumar Agrawal   | MECH       |                       |
|   | Vinitha               | EEE        |                       |
|   | Sarada                | EEE        |                       |
|   | Abhishek              | ICE        |                       |
|   | Himanshi              | EEE        |                       |
|   | Prathiba              | MET        | 90                    |
|   | Adithya. N            | ECE        | 94                    |
| K- Nearest Mean                         | M. Karthik Vijay      | CSE        | 85                    |
| SVM                                     | Aarthi                | EEE        | 90                    |
| Multiclass Logistic Regression Function | Ashwin Narayan        | ECE        | 95                    |

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### Quotes

*"Difficulties in your life do not come to destroy you, but to help you realize your hidden potential and power. Let the difficulties know that you too are difficult."* — Dr. A.P.J.Abdul Kalam

## CHALLENGE

Can you detect whether the given image is a photographic or photo realistic image.



The photographic versus photo realistic can be viewed as the two class supervised classification problem. The image under test is divided into sub blocks. Feature vectors are extracted from every sub blocks (say using ICA basis). The Euclidean distance between the feature vector obtained from the particular subblock and the centroids  $C_1$  and  $C_2$  (obtained using the training data) are computed as  $d_1$  and  $d_2$  respectively. Assign the number 1 to that particular subblock if  $d_1$  is lowest. Otherwise 0 is assigned to that subblock. This is repeated for all the sub blocks of the image to be classified. If the number of 1's is greater than 0's, decide that the image is photographic image. Otherwise the image is classified as photo realistic image.

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## Feedback

COMPSIG NITT invites articles and innovative ideas from readers for the [Reader's Space](#) column.

We expect feedback, comments and the articles to monthly newsletter [COMPSIG NITT](#).

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