DIGITAL SIGNAL PROCESSING

PROJECT

ECG BASED BIOMETRICS

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Chapter 1

Project Problem Definition

Biometrics is needed where security is essential

Biomedical signal processing aims at extracting significant information from **biomedical signals**

The electrocardiogram (ECG) has been used as a significant diagnostic tool for decades.

The physiological and geometrical differences of the heart among individuals reveal certain uniqueness in their ECG signals

In this project, we need to distinguish between three individuals using their ECG signals Using SIGNAL PROCESSING METHOD as Applying Some Pre-Processing in signal Such as REMOVING NOIS **(Main Removal, Filtering, Normalization)**

EXTRACTE Feature Applying Auto-Correlation,

DCT(Discrete Cosine Transform)

CASSIFICATION

Using Machine-Learning Technique **SVM(**Support Vector Machine**)** And **KNN(**K-Nearest Neighbors**)** Classifier To Classify And Recognition The Signal Of The Three Individual .

Chapter

2

Methodology :

❖ PREPROCESSING :

➢ Mean Removal

```
   meanRemoval=0
for i in range(len(signalData)):
   meanRemoval=meanRemoval+ float(signalData[i])
meanRemoval=meanRemoval/len(signalData)
for i in range (len(signalData)):
   signalData[i]=float(signalData[i])-meanRemoval
```

➢ Bandpass Filter (Butterworth 1 to 40 HZ)

Noise reduction : filters are used to remove frequencies outside the real frequency band of the signal

ECG band is 1 to 40 HZ

```
nyq=0.5*360
low=0.5/nyq
high=40/nyq
y,x=signal.butter(1,[low,high],'band')
outfilter=signal.lfilter(x,y,signalData)
```

➢ Normalization

segment the ECG signal into segments

❖Feature Extraction

➢ Frequency domain features

- auto correlation

  The auto-correlation function measures the correlation of a signal x(t) with itself shifted by some time delay

  Where correlation is a process of measuring the degree of similarity(dependency)between data sets(signals)

```
x=np.correlate(Data, Data , mode='full')
```

- discrete cosine transform (DCT)

  decompose a finite-length discrete-time vector into a sum of scaled-and-shifted basis functions

  The DCT uses only (real value)Cosine function

  DCT used in lossy data compression

```
def DCT(vector):
    result = []
    factor = math.pi / len(vector)
```

```
    for i in range(len(vector)):
        sum = 0.0
        for (j, val) in enumerate(vector):
            sum += val * math.cos((j + 0.5) * i *
factor)
        result.append(sum)
    return result
```

❖CLASSIFICATION

1. **Apply one of machine learning techniques SVM OR KNN**

2. **Compute And Display ACCURACY of Prediction For Selected Algorithm**

Chapter

3

Accuracies For Each Algorithm:

	SVM		*KNN*		
	LINEAR	**RBF**	**K=3**	**K=5**	**K=1**
S1	46.4%	75%	71%	67.8%	64.28%
S2	21.4%	17.4%	17.85%	28.75%	21.4%
S3	82.7%	86%	96.5%	79.3%	68.2%