Face Recognition

A Convolutional Neural Network Approach

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About article

Title: Face recognition: A convolutional neural network approach

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Authors: Steve Lawrence. Lee Giles, Ah Chung, Andrew (IEEE members)

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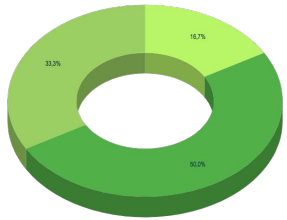


Introduction

- **PERSONAL IDENTIFICATION**
- Increased interest in using Biometrics
- Includes fingerprints, speech, signature dynamics & Face recognition
- More than $100 million products [1997 - 23 yrs]
- Non intrusive for personal identity.

- **TWO CATEGORIES FACE IDENTIFICATION**
- Non real time - search a person in big database
- Real time - allow a person, a security system

Identification methods

- **GEOMETRICAL FEATURES**
- Geometrical feature of face
- Ratio of distance among features
- Such as nose width
- Mouth position
- Chin shape

- **EIGENFACES**
- High level recognition task - many stages of processing
- Images are projected to principal components

Identification methods

- **TEMPLATE MATCHING**
- Direct correlation of image segments
- Images have the same scale - effective

- **GRAPH MATCHING**
- High level recognition task - many stages of processing
- Images are projected to principal components

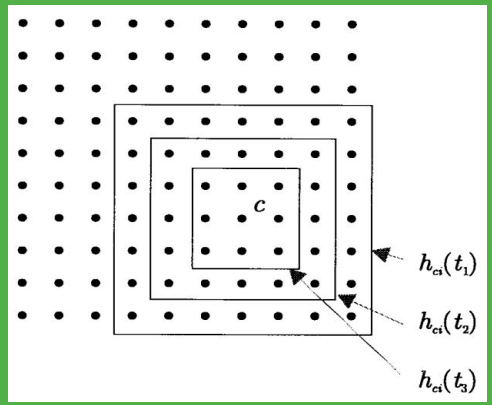
Identification methods

- **NEURAL NETWORK**
- Small number of classes
- Features extracted and reduced to fewer dimensions
- Classified using MLP (multilayer perceptron)

- **HMM**
- Hidden markov model classification
- 13% error rate
- Own implementation - 10% error rate

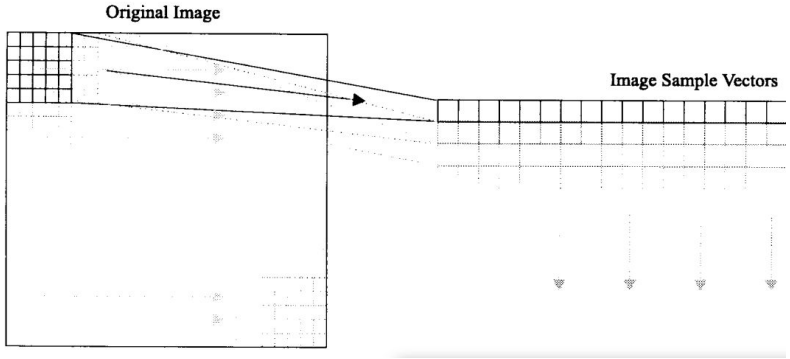
System Components

- Local image sampling for partial lighting invariance
- SOM - A self organizing map - for projection of the image sample (fig)
- More than $100 million products [1997 - 23 yrs]



Components

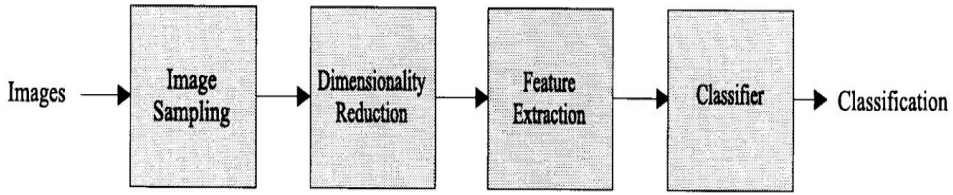
- LOCAL IMAGE SAMPLING
- 2 Methods
- A window is scanned over the image
- The first method creates a vector form
- Intensity values at each point in the window
- The second method creates a representation of the local sample
  - Intensity of the center pixel
  - The difference in intensity between the center pixel and all other



Components

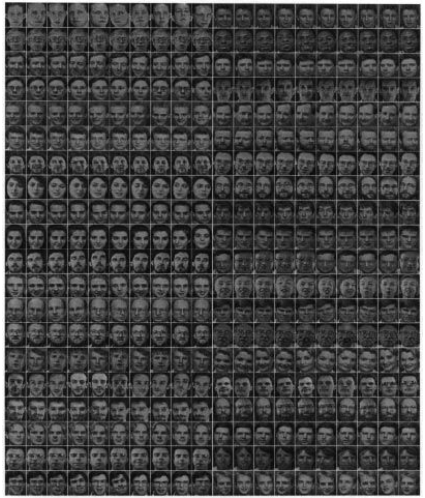
- **SELF ORGANIZING MAP (SOM)**
- Maps are important part of ANN and information processing systems
- Examples : retinotopic, tonotopic,
- SOM is like a classification technique at is provides topological ordering

- **KL TRANSFORM**
- Linear method for reducing redundancy in dataset
- Uses PCA - principal component analysis
- Does feature extraction
  - Generates a set of orthogonal axes of projections known as principal components



Results

- **400** images
- 200 for testing and 200 training
- 40 Persons
- 5 images/person 3.8 % error
- 10 images/person 10.5%



Comparison

Method	Kanade	Brunelli	Cox
Geometrical	45 - 75 % success 20 persons	90% success 47 persons	95% 95 persons

Method	Turk	Pentland	Cox
Eigenface	96, 85, 64 % Lighting, orientation, scaling	95% success 200 persons	95% 95 persons

Thanks!

ANY QUESTIONS?

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