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Face Recognition-based Automatic Tagging Scheme for SNS

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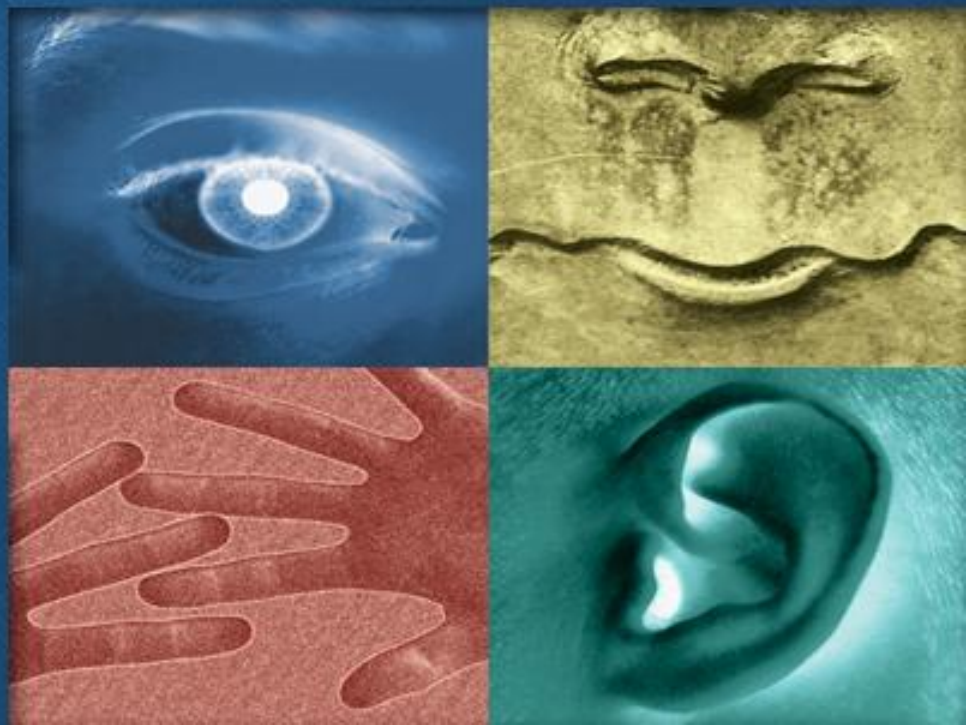


Outline

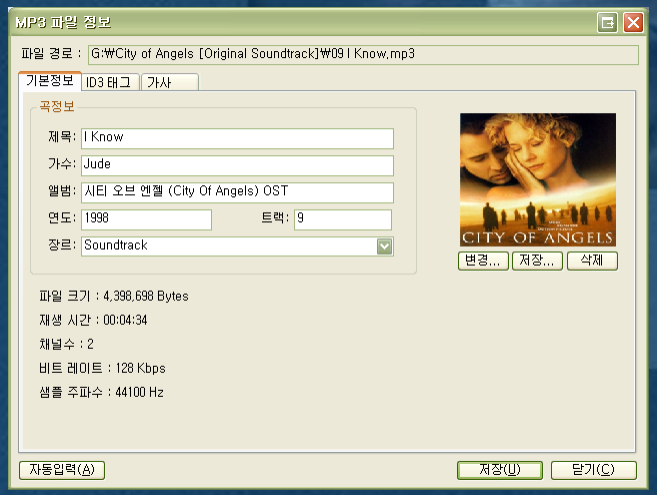
- Introduction
- Motivation
- Related Work
- Methodology
  - Face Detection
  - Face Matching
- Experimental Results
- Conclusion

Introduction

- Tag is…
  - Metadata related with Internet Contents
  - Used by Most Web 2.0-oriented websites
  - Effective Information Classification System
- Applications
  - Tag Cloud, Location Tag, Photo Tag
  - Collaboration Tagging, Auto Tagging
- Problem
  - Abuse / Misuse of Tag (spam tag)
  - Troublesome work for normal user
  - Not interesting

Motivation

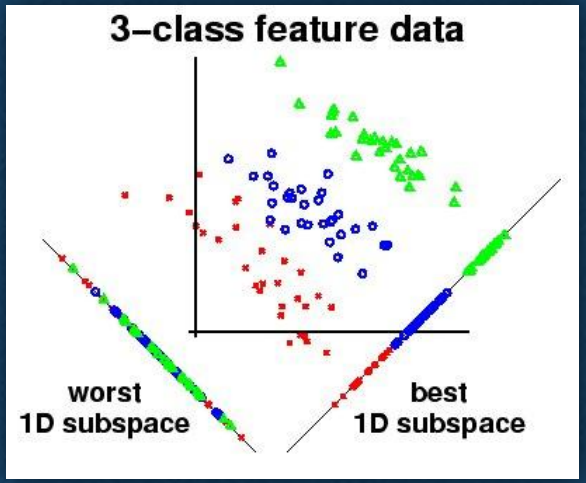
- Automatic Tagging
  - Using algorithms of pattern recognition
  - Prevent inappropriate, unnecessary tagging
  - Exact & Convenient



- Facial Tagging
  - Tag whose name on his/her face
  - Novel & Fun (image-based)
  - Applicable to various field
    - People Searching
    - Categorize pictures by relationship

Related work

- Face Recognition Methods
  - Principal Component Analysis *(M. Turk & A. Pentland, 1994)*
  - Linear Discriminant Analysis *(S. Balakrishname & A. Ganapathiraju, 1998)*
  - Neural Network *(J. E. Meng & W. Shiqian, 2002)*
  - Gabor Wavelet *(L.C.Jain & U.Halici, 1999)*
  - Support Vector Machines *(E. Osuna, & R. Freund 1997)*

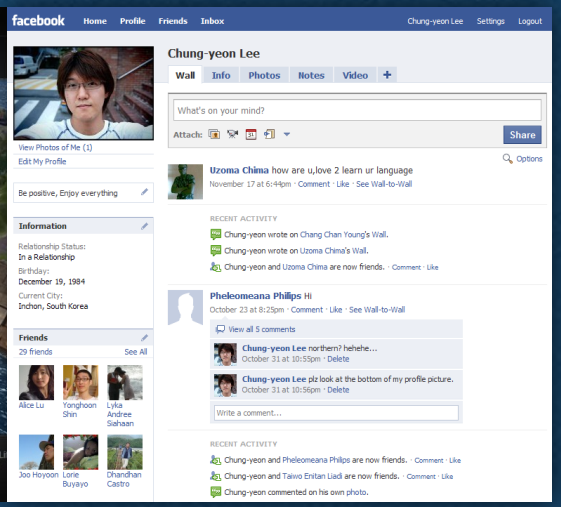


Related work

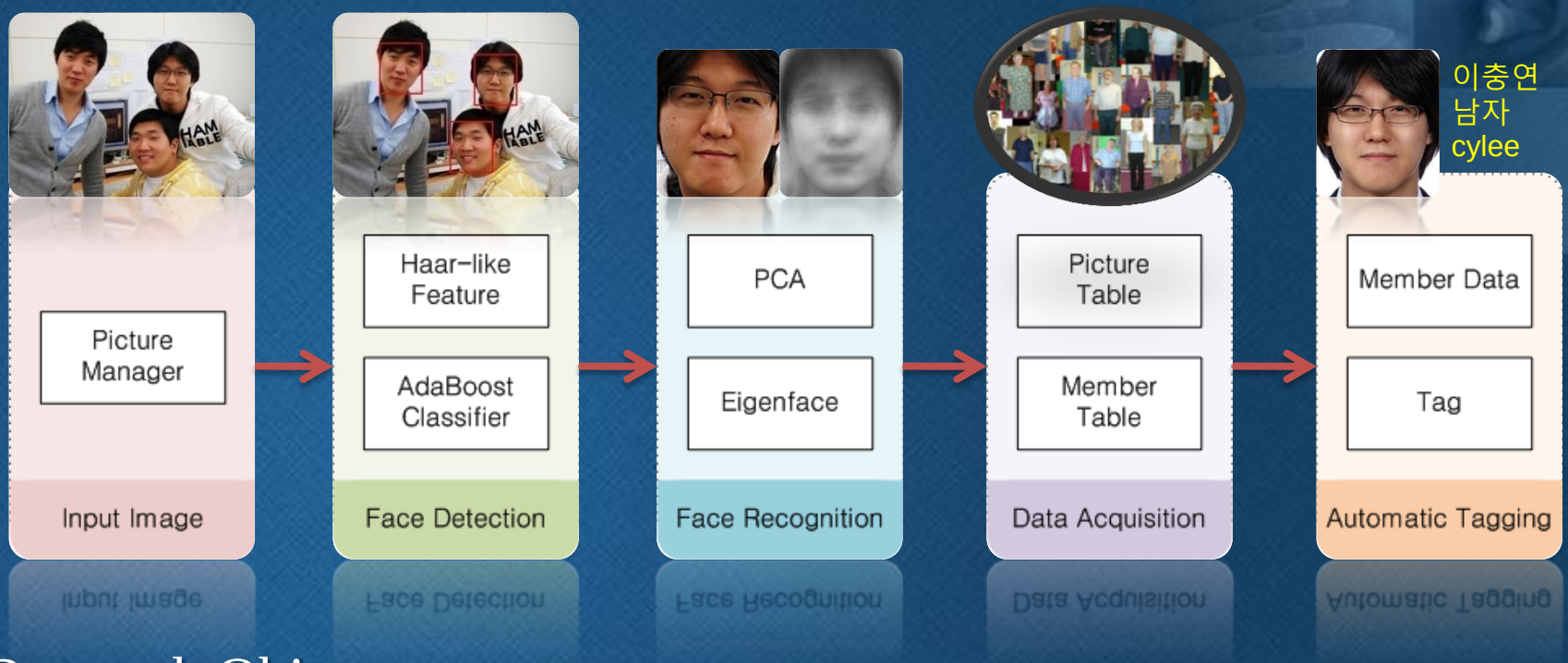
- Face Detection Methods
  - Knowledge-base Method *(G. Yang & T.S. Huang, 1994)*
    - Geometric features, Histogram
  - Feature-based method *(R. Kjeldsen & J. Kender, 1996)*
    - Facial elements, texture, skin color, outline, or combination of them
  - Template Matching Method *(I. Craw et al., 1992)*
    - Standard facial templates (created manually)
    - AAM(active appearance model), ASM(active shape model)
  - Appearance-based Method *(M. Turk & A. Pentland, 1991)*
    - Using classifiers that is learned features of face
    - PCA, SVM, HMM, NN, etc.

Related work

- Social Network Service (SNS)
  - Internet service supporting social network on the web
  - Sharing personal daily life or interesting things with UCC
  - A value-added killer-app in Web 2.0
  - Cyworld, Facebook, Myspace, Twitter, Me2day, Mixi, etc.
    - Including Blog, Café and Virtual world(Second Life)



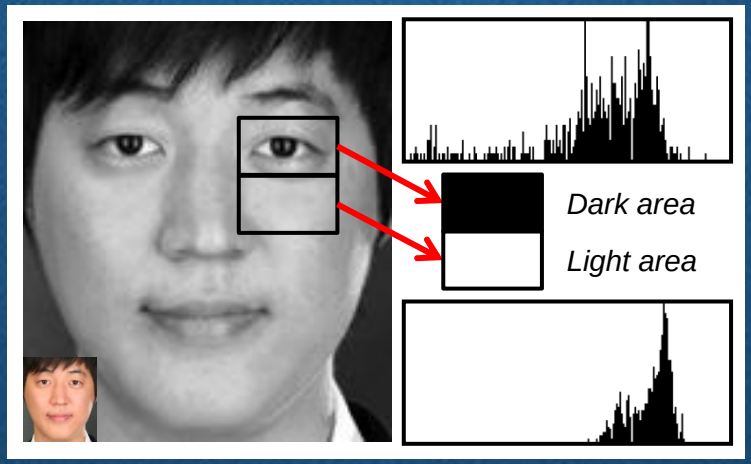
Methodology

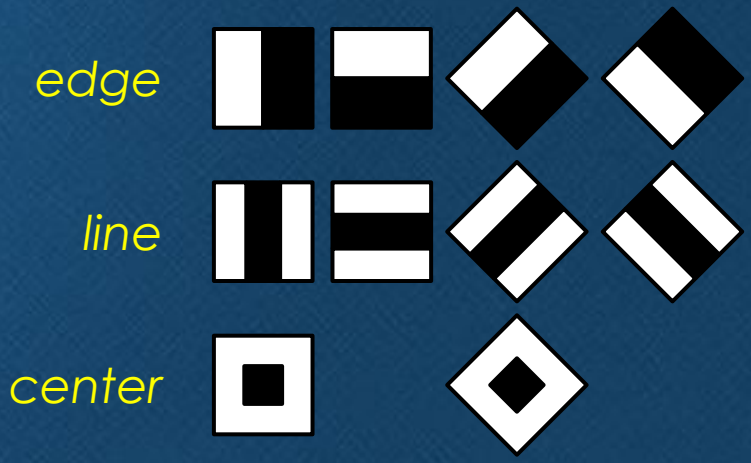


- Research Object
  - Detect faces in pictures on the picture management system of SNS
  - Match the face to the member data and display it
  - Tag his/her name on the picture

Methodology

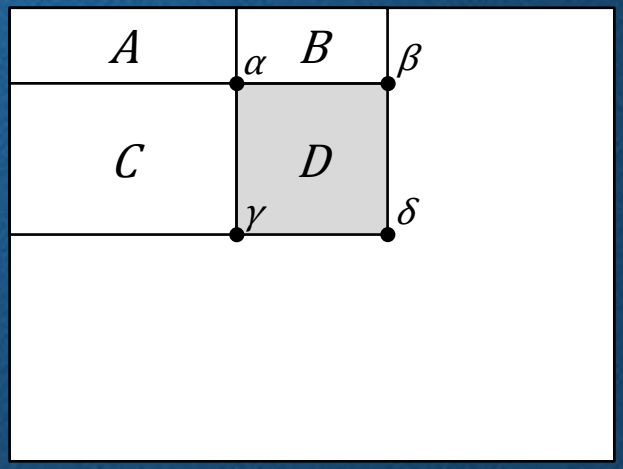
- Face Detection
  - Haar-like features
    - Calculate the difference of the sum of pixels of areas inside the rectangle
    - The values indicate certain characteristics of a particular area of the image
    - Each feature type can indicate the existence of certain characteristics in the image, such as edges or changes in texture.





Methodology

- Face Detection
  - Using Integral image for fast computation
    - Summed area tables: 2D Lookup table with the same size of the original image
    - Each element of the Integral Image contains the sum of all pixels located on the up-left region of the original image
    - It allows to compute sum of rectangular areas in the image, at any position or scale, using only 4 lookups: $sum = \alpha - \beta - \gamma + \delta$



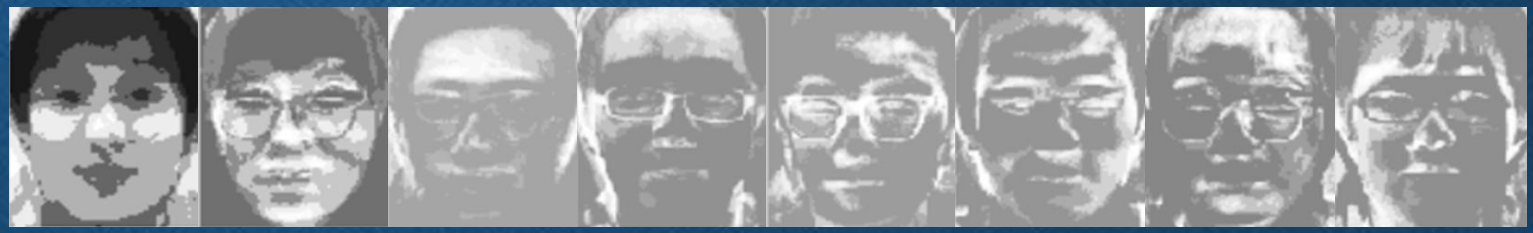
Methodology

- Face Detection
  - Classifier Learning using AdaBoost
    - A weak classifier is called repeatedly in a series of rounds $t = 1, \ldots, T$
    - For each call, a distribution of weights D_t is updated that indicates the importance of examples in the data set for the classification.
    - On each round, the weights of each incorrectly classified example are increased, so that the new classifier focuses more on those examples.

Methodology

- Face Matching
  - Feature Extraction
    - Make a face vector from face image
    - Extract its eigenvector and eigenvalue using PCA
    - Since the feature seems like a face, it is dubbed ‘eigenface’

  - Recognition & Matching
    - Compare the feature vector of input image with the feature vectors of learned image set
    - The face has minimum euclidean distance is the closest one
    - So, it returns the index number and seek the member data from DB



Experimental Results

- System Overview

Detected facial region

Input tag list

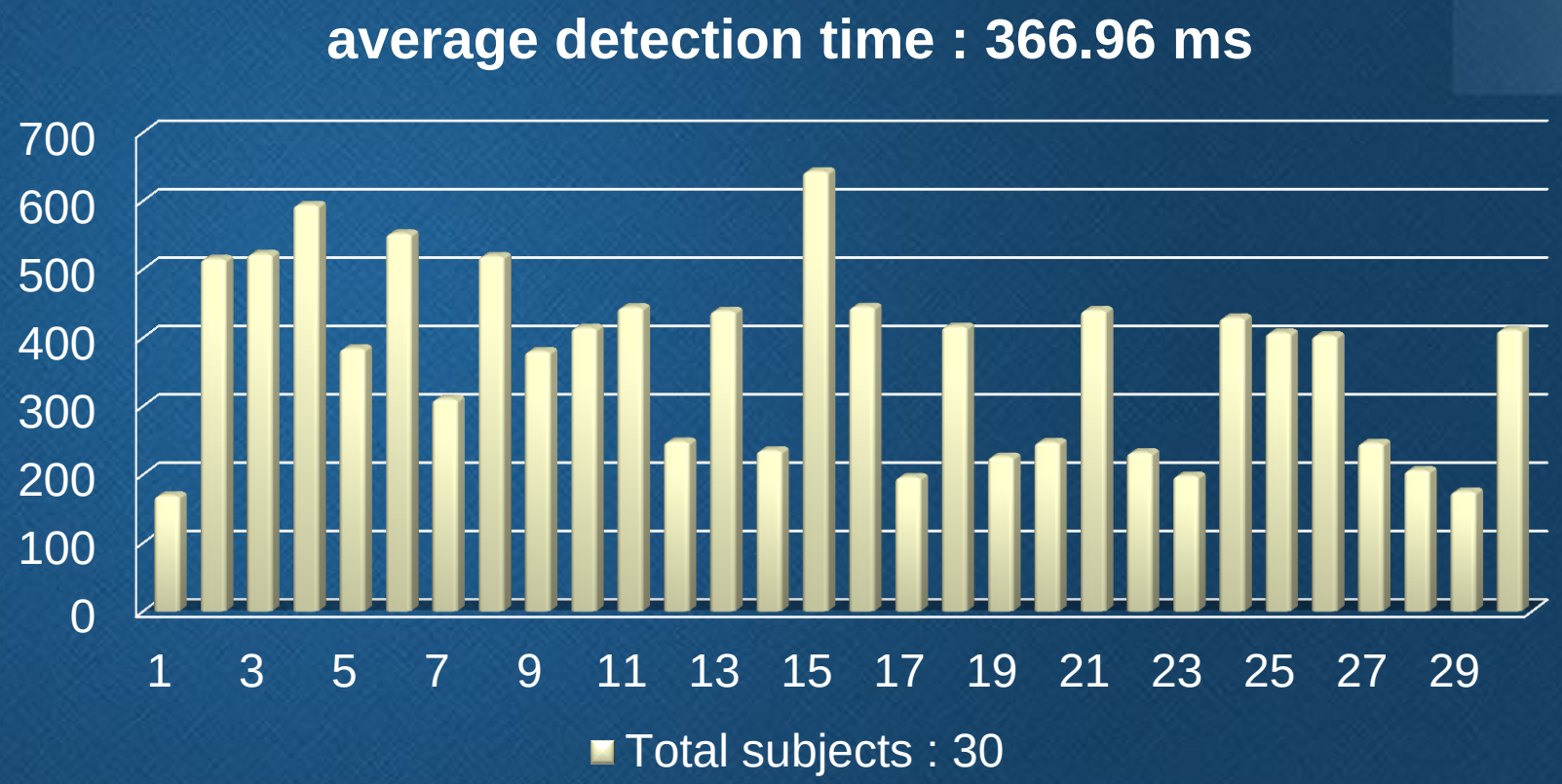
Recognized Profile

Trimmed facial region

Activate face detection

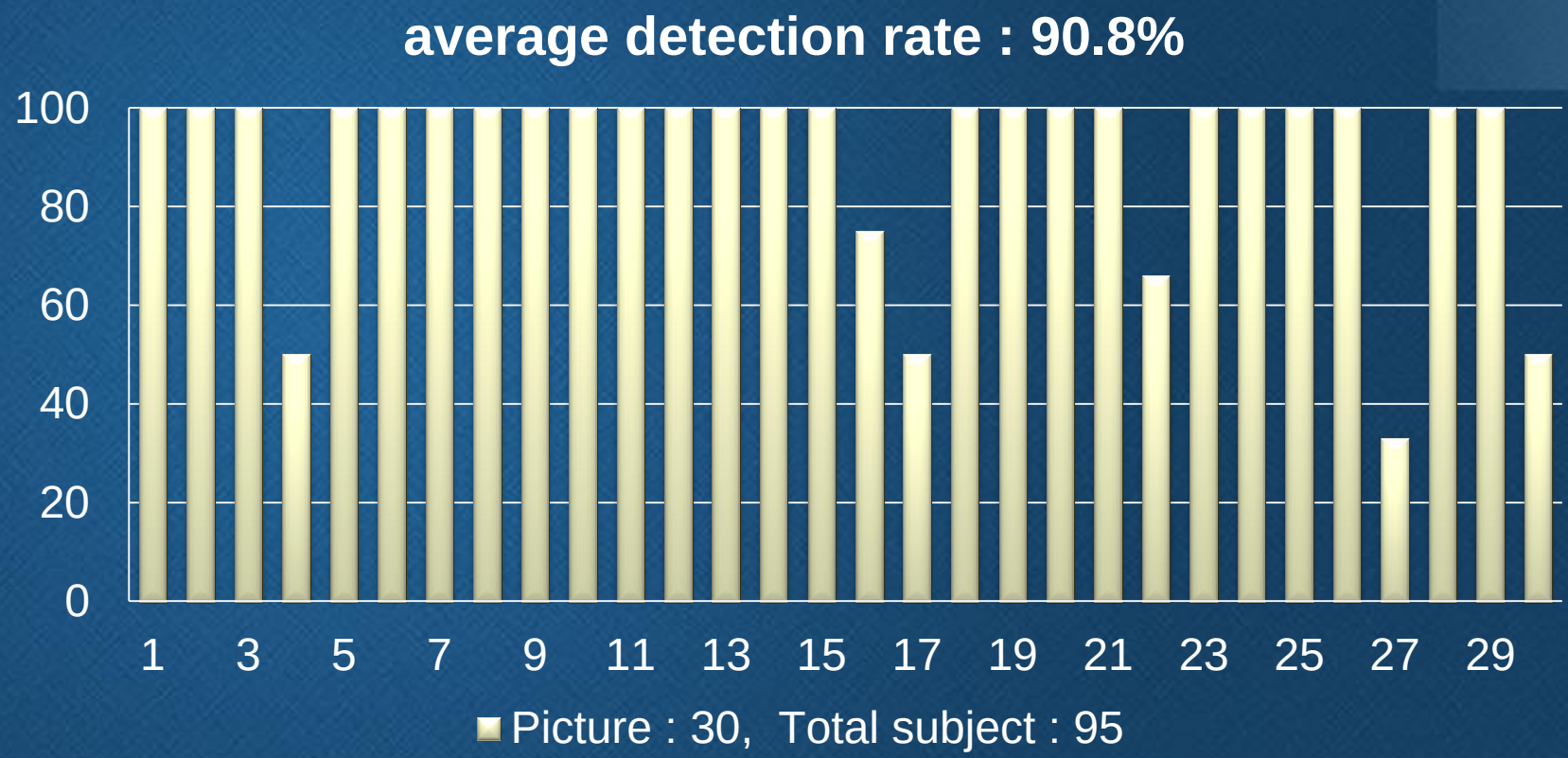
Experimental Results

- Detection time



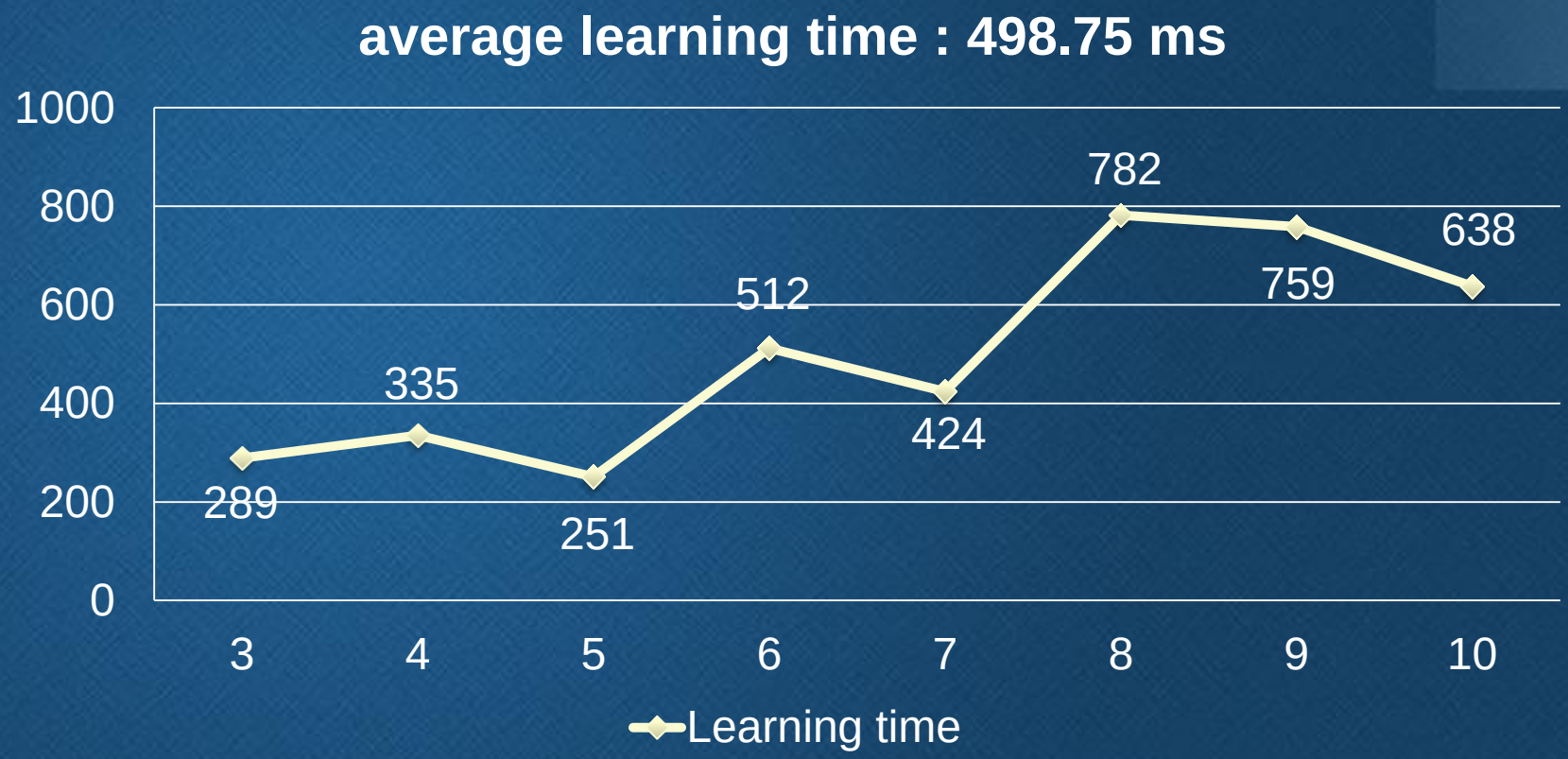
Experimental Results

- Detection rate



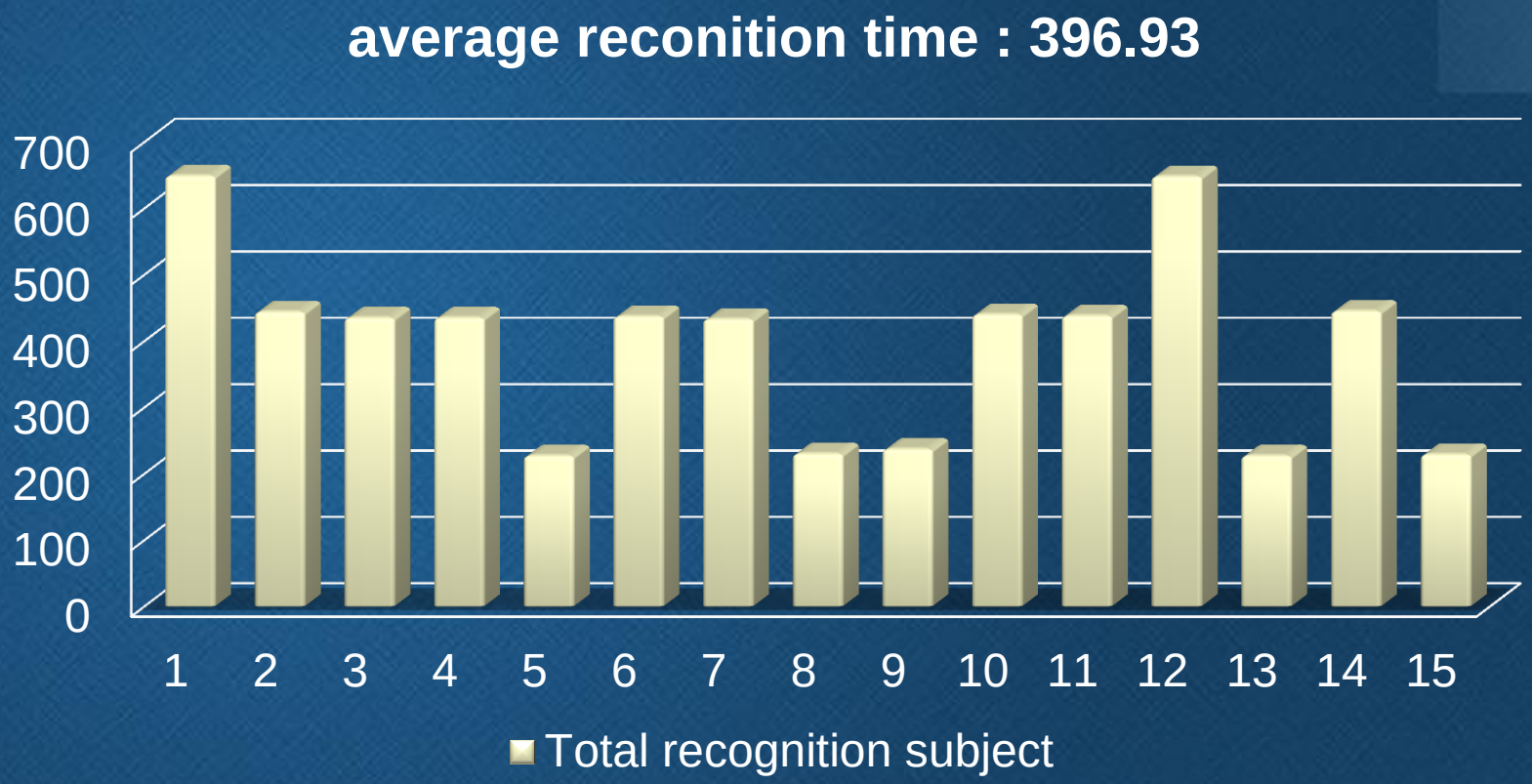
Experimental Results

- Learning time



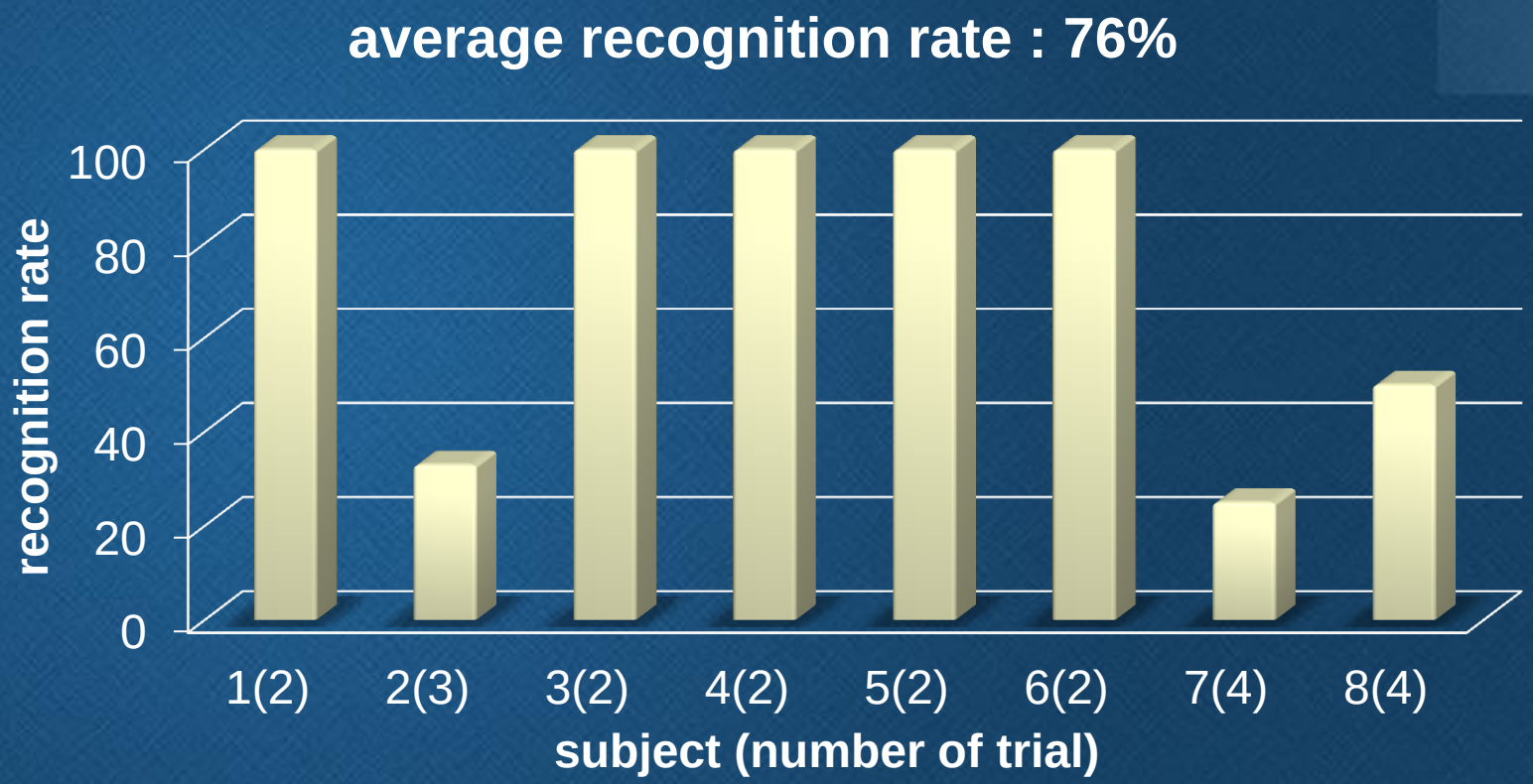
Experimental Results

- Recognition time



Experimental Results

- Recognition rate



Thank you