Glasses Detection Based on Bayes Decision Rule

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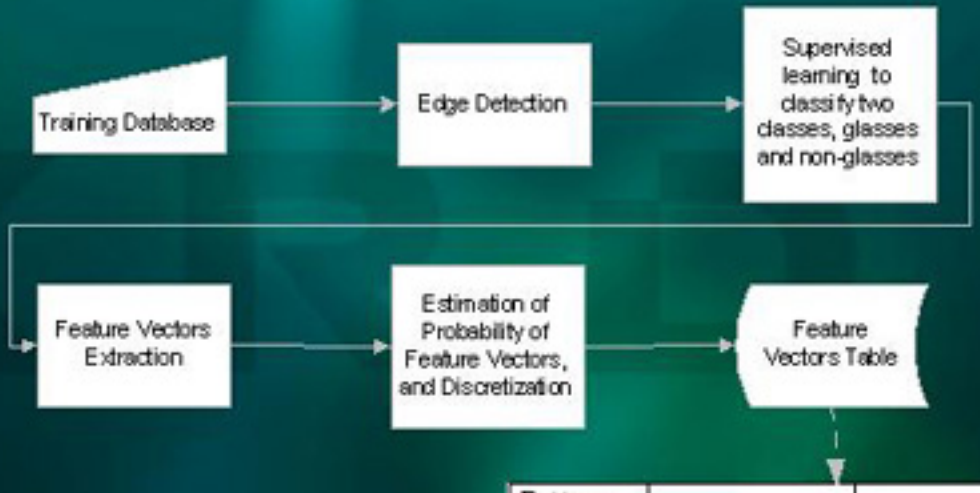
- Aim
  - To achieve a face recognition system robust to the presence of glasses, we have developed a glasses detection and extraction algorithm.
- Problems
  - Drawbacks of the original method which is achieved with a deformable contour, combining edge features and geometrical features.

  - Now, we get the extracted glasses points, how to remove them?

Overview of our method

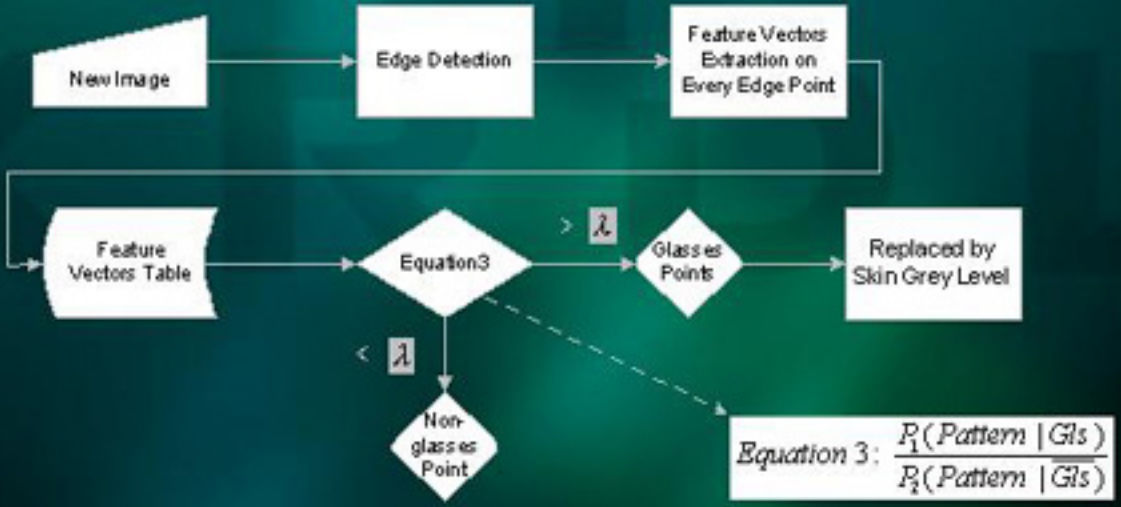
- Learning phase



Pattern	$P_1(Pattern \mid Gls)$	$P_2(Pattern \mid \overline{Gls})$
1	…	…
2	…	…
…	…	…
N	…	…

Overview of our method (continued)

- Recognition phase



Review of Bayes Decision Rule

$$P(Glasses \mid Pattern) \underset{\overline{Glasses}}{\overset{Glasses}{\gtrless}} P(\overline{Glasses} \mid Pattern) = 1 - P(Glasses \mid Pattern) \quad (1)$$

$$\begin{cases} P(Glasses \mid Pattern) = \dfrac{P(Pattern \mid Glasses)P(Glasses)}{P(Pattern)} \\ P(\overline{Glasses} \mid Pattern) = \dfrac{P(Pattern \mid \overline{Glasses})P(\overline{Glasses})}{P(Pattern)} \end{cases} \quad (2)$$

$$\frac{P(Pattern \mid Glasses)}{P(Pattern \mid \overline{Glasses})} \underset{\overline{Glasses}}{\overset{Glasses}{\gtrless}} \lambda = \frac{P(\overline{Glasses})}{P(Glasses)} \quad (3)$$

Extraction of Feature Vectors

- The Feature Vector is described as:
  - FV=(Texture, Moment, Direction, Distance to Eye, Direction and Intensity of Edge)
- The Confusion Near Glasses Points
  - Eyebrow, Hair, Eye, Nose, Wrinkle...

Vector Quantization and Estimation

- Size of Training Data
  - 50 x 50 x 9 x 2 x 2
- Vector Quantization by Clustering
  - Euclidean Distance
- Estimation of Probability

Experiments and Results of Glasses Detection

Table 1. Comparison of Average Errors of Two Detection Algorithm in 29 Facial Images

Table 2. Comparison of False Detection

Detection Algorithm	Based on Edge of Glasses Ridge	Based on Bayes Rule
False Detect Rate	2/419	0/419

Results of our algorithms of glasses detection and removal