

used to capture diff information (length, width, area) \Rightarrow for recognition purposes

Ex: A cascaded multimodal natural user interface to reduce driver's distraction (IEEE paper)

5 $\left. \begin{array}{l} \hookrightarrow \text{speech + button} \\ \hookrightarrow \text{speech + touch} \\ \hookrightarrow \text{gaze + button} \end{array} \right\} \text{different cascading techniques for autonomous vehicle.}$

Ex: (Speech + gaze = "Turn on music" + (increase volume by moving hand up or down))

RECS

15 if ~~bad~~ lighting conditions = problem may be there

facial recog \Rightarrow 3D model based techniques, variation of angle of hand is used & detection is used.

20 Hand Gesture \Rightarrow video is taken & then frames of video taken to capture hand

25 * 1 gesture can be provided in several ways.

* Application of facial recog

\hookrightarrow Viola-Jones algorithm

30 Viola Jones = to extract facial features using Haar-like features.

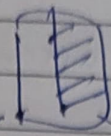
\hookrightarrow can be used to train diff. objects/body parts. Camlin

Challenges of face detection \Rightarrow ~~feature extraction~~ ~~recognition~~

Page:

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like
Haar like features



brighter

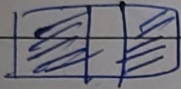
darker

8-10 Haar like features

(Combination of black & white patches)

these patches made to detect features from ~~single~~ face

to extract information about nose



* Different Haar like features for eyes, nose, lips, mouth
(to extract features from facial image)

* By default, it select 4 facial features:

- ① eyes
- ② nose
- ③ mouth
- ④ mouth + nose

II Creating an integral image = Facial features are combined to extract information.

III Adaboost training

IV Cascading

can also detect upper part of body

if 8/10 features matched, then it is face of

that particular person A

lec 6

occluded = overlapping

* Challenges of face detection / things that affect face detection also

- ① Pose
- ② Presence or absence of structural components
- ③ facial expression
- ④ occlusion (many faces are there)
- ⑤ Image orientation
- ⑥ imaging (lighting) conditions

To deal with challenges

knowledge based method = rule based method

mathematical based method

(dist b/w eyes, ^{nose} & nose, ~~eye~~ & lip)

"not much used"

Problems: if we take mathematical calculations, then these calculations may change with orientation change of face (if orientation variation, change of camera)

"if face is static (face is not moving, much)"

* feature-invariant approachesinvariant to expression
facial ~~features~~

→ Some features generated ^{from} face which will be invariant to lighting conditions, pose, angle & so on

→ diff. methods to find those feature points.

→ Used because of its invariant prop.

→ widely used

→ edge detection, texture of face.

→ All features combined to detect the face.

* Template matching

not much used

- Match template with current image
- correlation based method

Cons = template & image must comprise of almost similar image otherwise detection may not work correctly (if not much diff. b/w input image and template)

- correlate with templates stored in folder
- if ^{whole} image is only rotated, then template will work but if face is rotated by θ , then will not work.

* Appearance based method = widely used

- training based method.
- folder \Rightarrow lot of illumination variation, diff faces,
 train angle variation.
- \Rightarrow ~~detector~~ for detection.

" SVM, NN

- Train dataset & use information to detect face.

* Diff types of Feature :

- ① SIFT (Scale invariant Feature transform)
- ② HOG (Histogram of gradients) \Rightarrow colour info
- ③ LBP (Local binary Pattern) \Rightarrow edges & how allocated.
- ④ SURF (Speeded up robust Features)
- ⑤ DAISY features.
- ⑥ ICF (Integral channel Feature)

* HOG \Rightarrow used for ~~edge~~ colour info \perp info about
~~edge~~ edges / lines.

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\rightarrow Knowledge based methods

(ex: Attendance marker (Person has to come at camera
& mark attendance)

\rightarrow Feature invariant

\rightarrow Template matching = ~~not~~ used for recognition purpose
(whether particular student present
in a group of students
picture)

feature comb = nowadays many used.