FACE RECOGNITION

RENEWED INTEREST ?

Late 60's ~ Early 70's

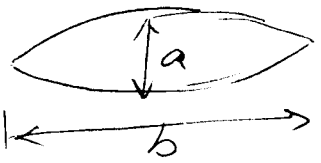
Harmon - Profile, Expression (Manual)
Widrow - Rubber Matching
Kelly - Edge Detection by Planning
Kanade - Feedback, 1000 images
Fischler - Flexible Templates

Recent

Graphics - Face Animation
Neural Net - Face image matching
Witkin, Yuille - Deformable template matching of eyes, lips,
Petajan - Lip Reading (Binary)
Mase - Lip Reading (Optical Flow)

Face Recognition – Renewed interest ?

Deformable template

$T(\text{param})$ 

$\bar{\Phi}_p$

Image $\xrightarrow[\text{Feature Ext}]{}$ $\bar{\Phi}_p$ $\longrightarrow$ Energy Minimization = Matching + Internal potential

$T(\text{param})$ $\nearrow$

Energy Function

$$E_e = \int_{\text{boundary}} \bar{\Phi}_e(x)\, ds$$

$$E_i = (ka - b)^2$$

Late 1960's ~ Ecarly 1970's

2D Face Recognition

Harmon – Profile (Manual)
Widrow – Rubber matching
Kelly – Edge detection by Planning
Kanade – Feedback, 1000 faces
Fischler, Fischein – Flexible templates

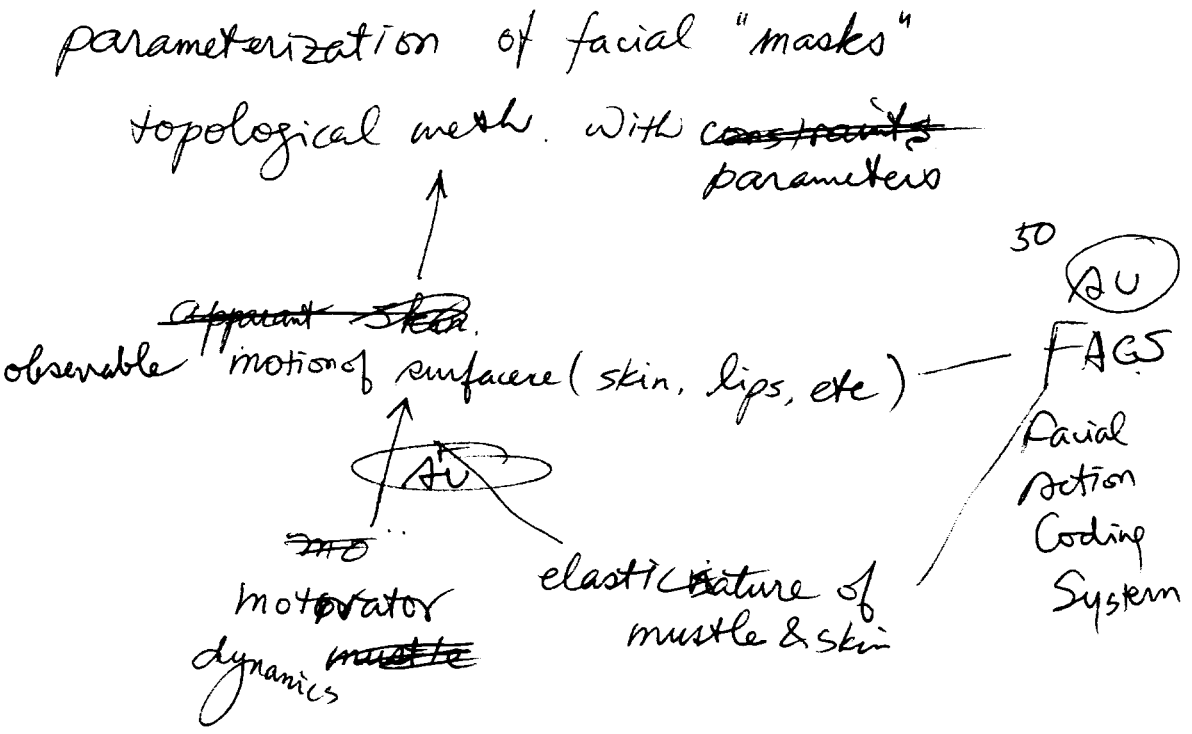
Recent

Witkin, Yuille – Template matching of Eyes, Lips
Petajan & Lip reading
Mase

Graphics – Animation

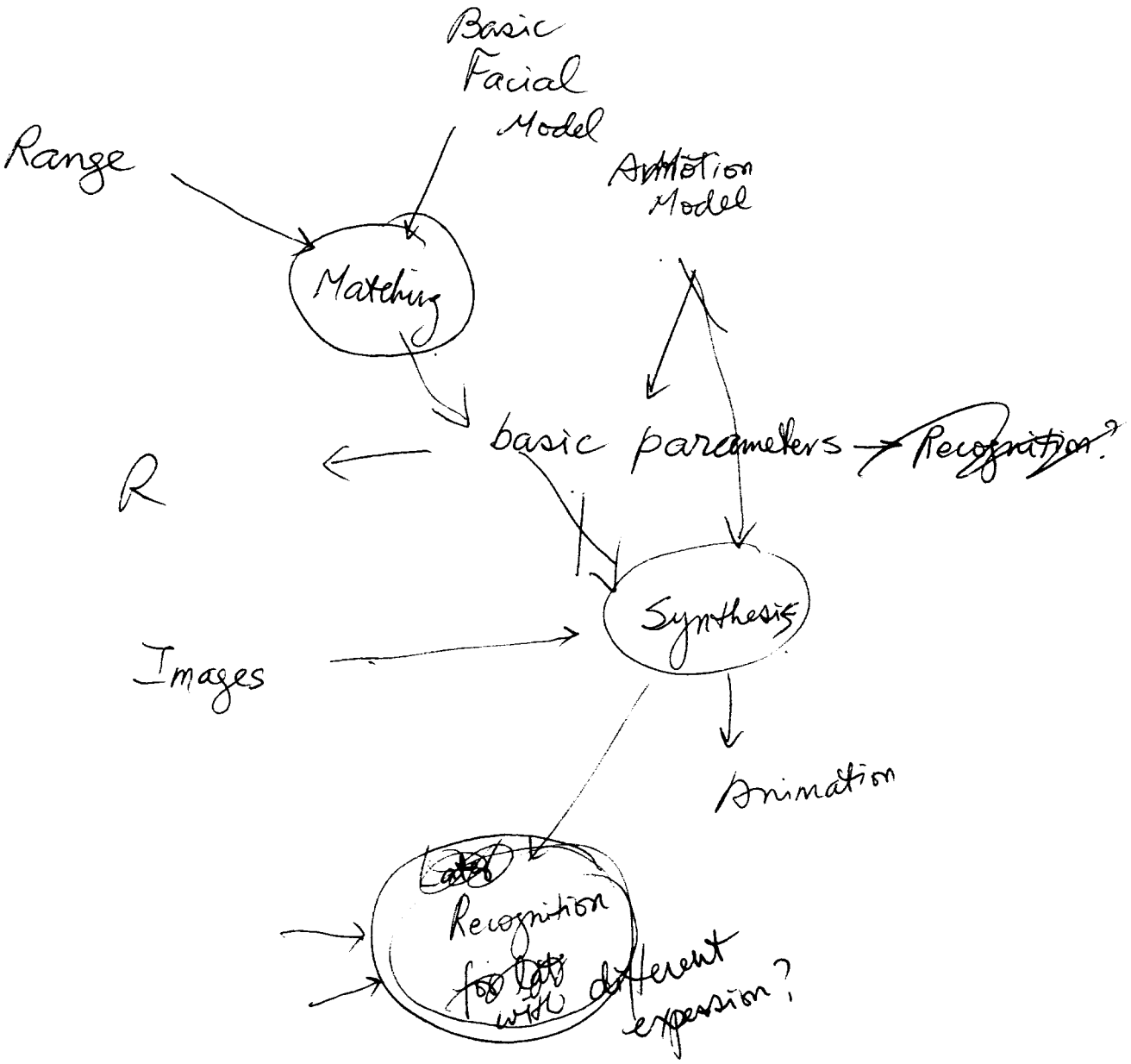
Neural Net – Face image matching

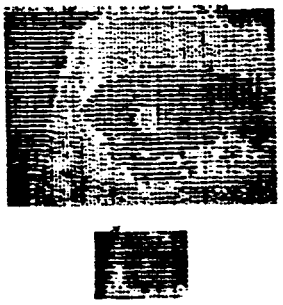
Animation of Facial Expression.



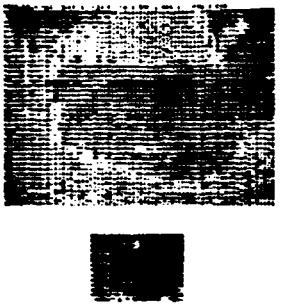
Application ?

- Security
- Transmission
- ~~DE~~ [redacted]
- Video research

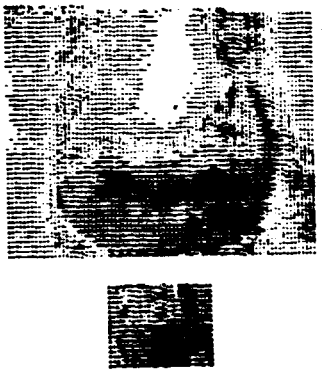

Basic
Facial
Model
Range
Motion
Model
Matching
basic parameters
Recognition?
R
Synthesis
Images
Animation
Recognition
different
expression?



(a) Right eye

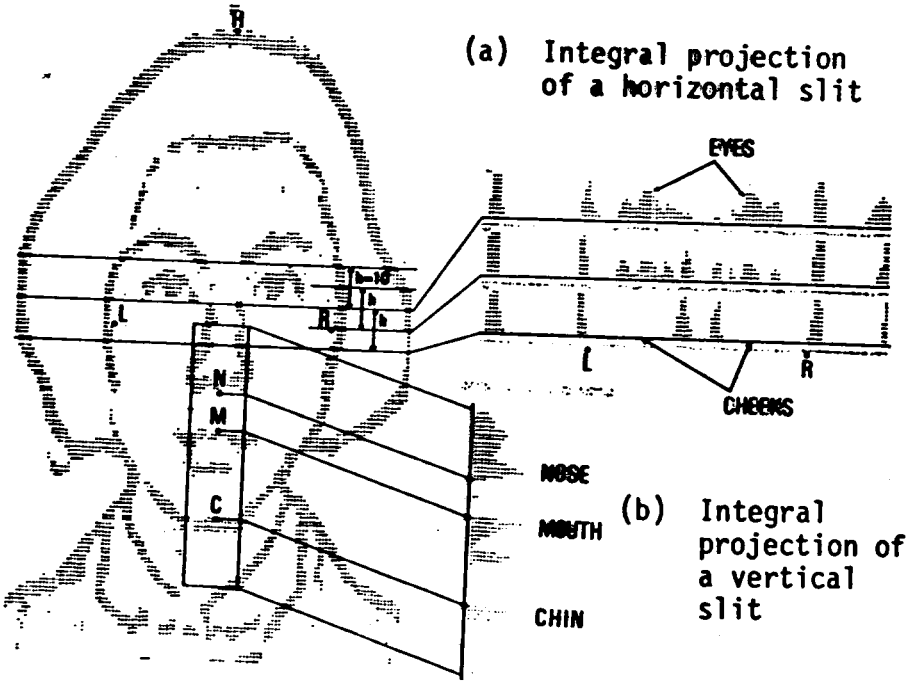


(b) Left eye



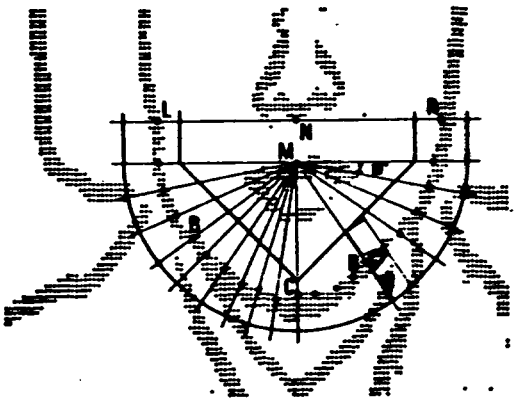
(c) Nose

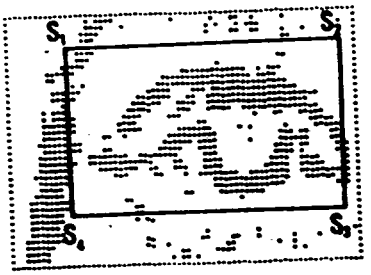
(d) Mouth



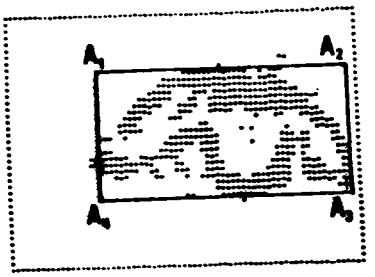
(a) Integral projection of a horizontal slit

(b) Integral projection of a vertical slit

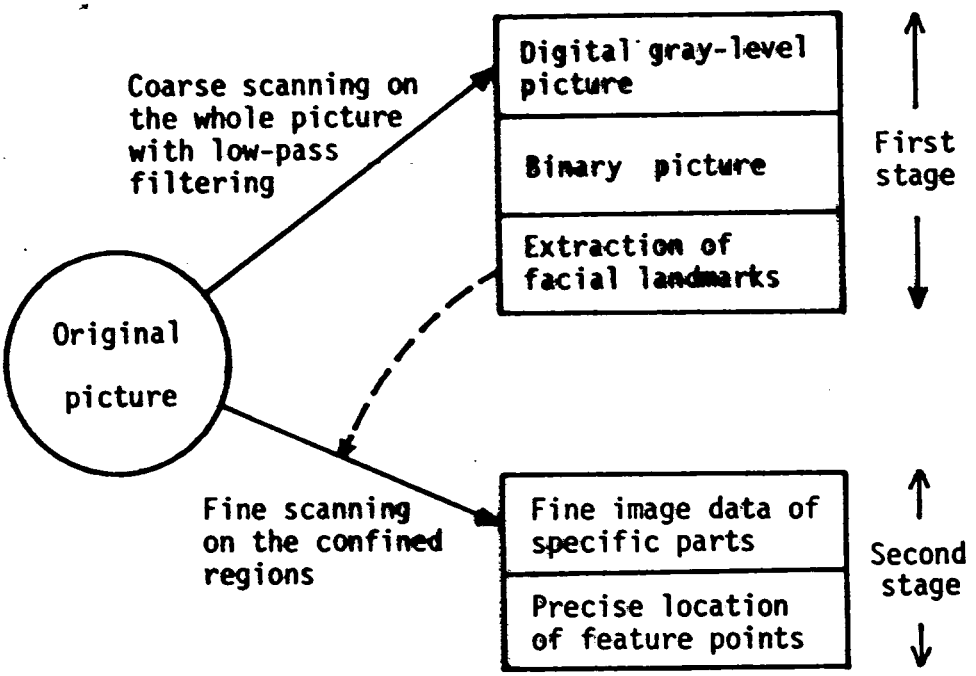

L
N
M
C



(a) Elimination of irrelevant portions



(b) Determination of eye rectangle


Coarse scanning on the whole picture with low-pass filtering
Digital gray-level picture
Binary picture
Extraction of facial landmarks
First stage
Original picture
Fine scanning on the confined regions
Fine image data of specific parts
Precise location of feature points
Second stage

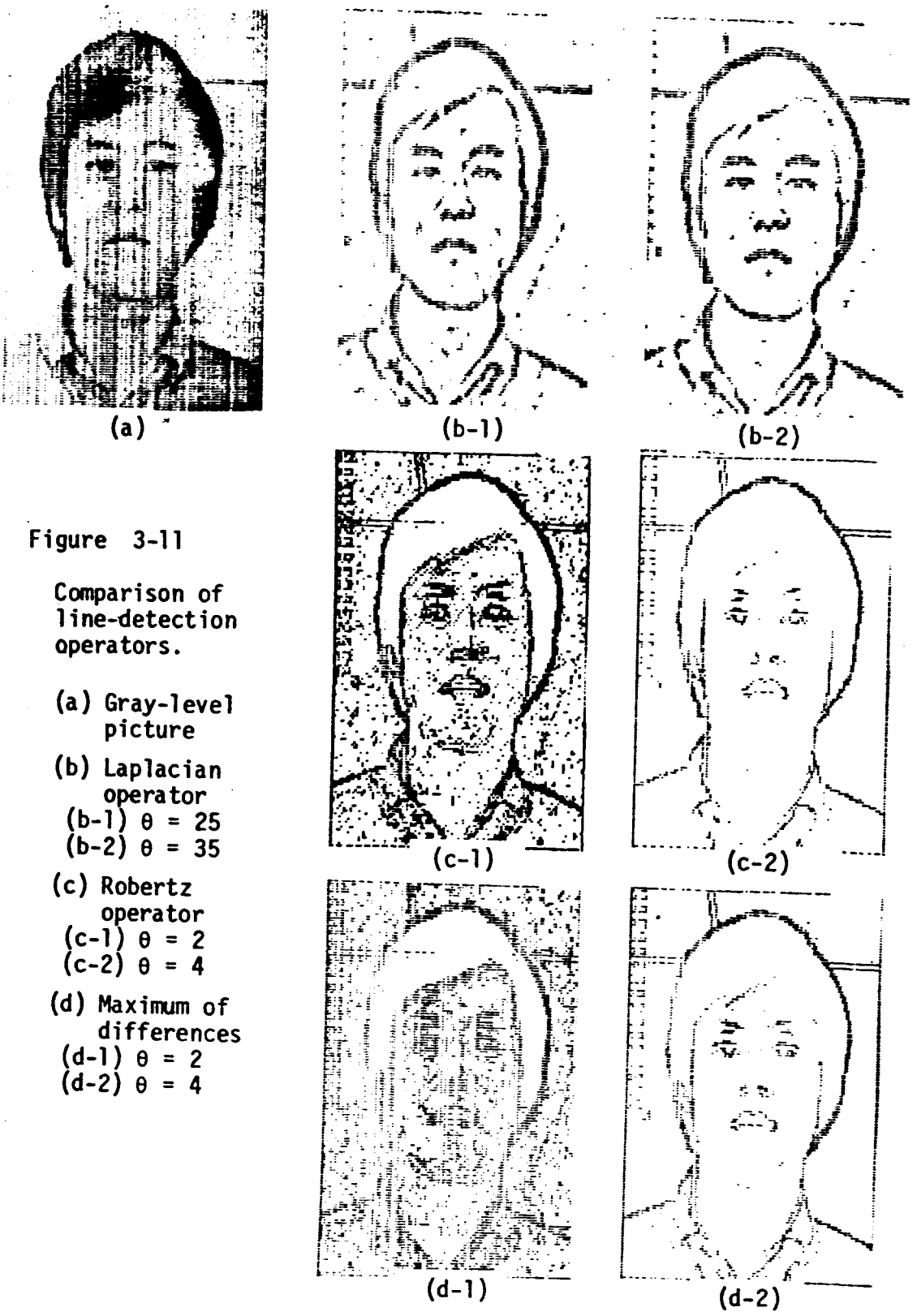


Figure 3-11

Comparison of line-detection operators.

(a) Gray-level picture

(b) Laplacian operator
(b-1) $\theta = 25$
(b-2) $\theta = 35$

(c) Robertz operator
(c-1) $\theta = 2$
(c-2) $\theta = 4$

(d) Maximum of differences
(d-1) $\theta = 2$
(d-2) $\theta = 4$