



# AUTOMATIC HUMAN AGE ESTIMATION SYSTEM FOR FACE IMAGES

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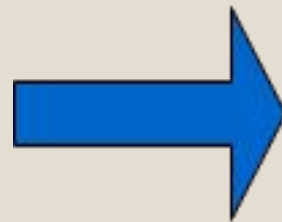
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# OUTLINE

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# Problem Statement

- **Facial Age Estimation:**
  - **Label** a face image automatically with the exact age (year) or the age group (year range) of the individual face



# Motivation

1, Age estimation is the base for human to communicate and understand each other.

- age determines the level of communication.
- people age determines their preference and habits
- identify biological changes such as skin wrinkles, gray hairs, etc. as age advances.

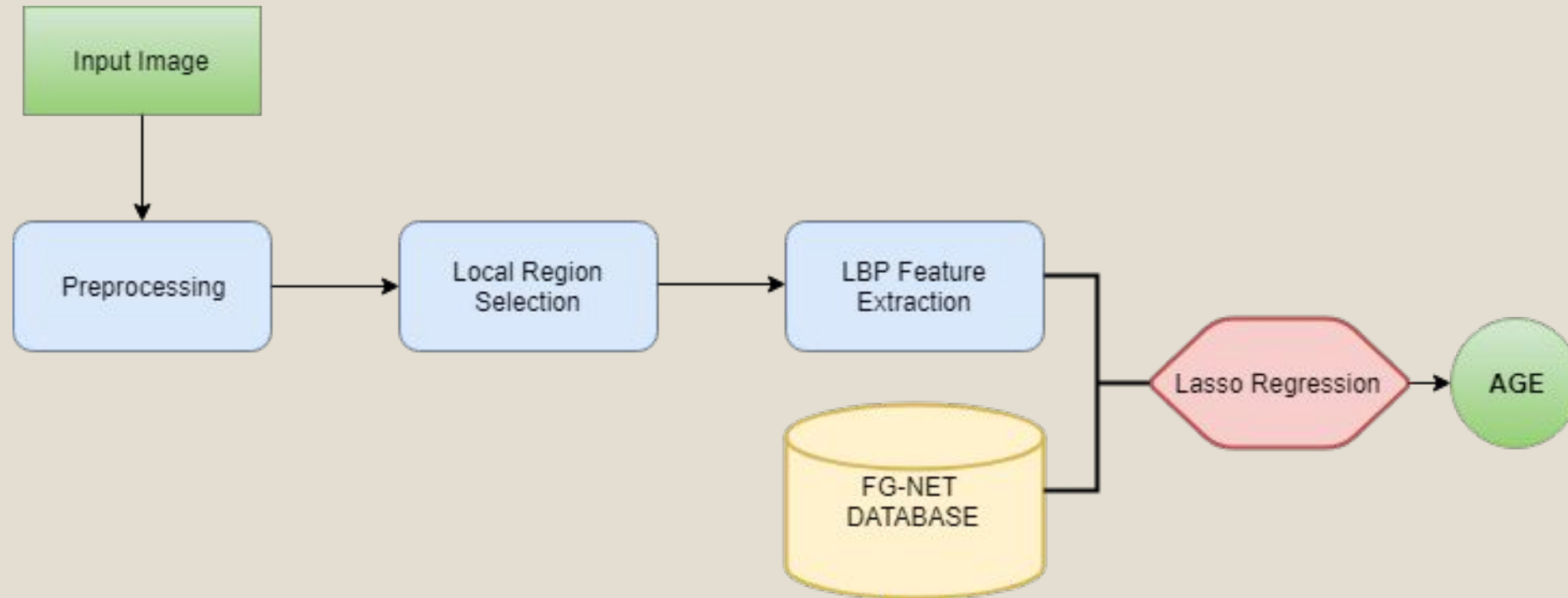
2, Age estimation helps for surveillance

- reduces costs and saves time during investigation
- enable to recognize lost person

# Related Work

Reference	Feature extraction	classifier	database	Training/Testing	Performance/MAE
[6]Ni, Bingbing, et al	PCA	multi-instance regression	FG-NET/ MORPH	600 training 402 testing images	9.49/7.42
[2] Li et al. 2015	Boosting Algorithms	Two-layer	FG-NET/ MORPH 55,000 IMAGES	first and second boosting	3.76
[3] Geng et al	PCA	AGES	FG-NET/MOR PH	515 Training/82 testing	6.77
[4]Choi et al.	Global and local feature extraction	hierarchical	FG-NET,BER C AND PAL	LOPO	4.66

# Method--Age estimation system



# Method--local binary pattern

- Assign a code to each pixel comparing it to its neighbors
- Description of pixels neighbourhood
- Binary short code to describe neighbourhood
- Operates by taking difference of central pixel with neighbouring pixels

$$LBP_{P,R} = \sum_{p=0}^{P-1} s(g_p - g_c) 2^p, \text{ where } s(x) = \begin{cases} 1, & x \geq 0 \\ 0, & x < 0 \end{cases}$$

# Method--local binary pattern

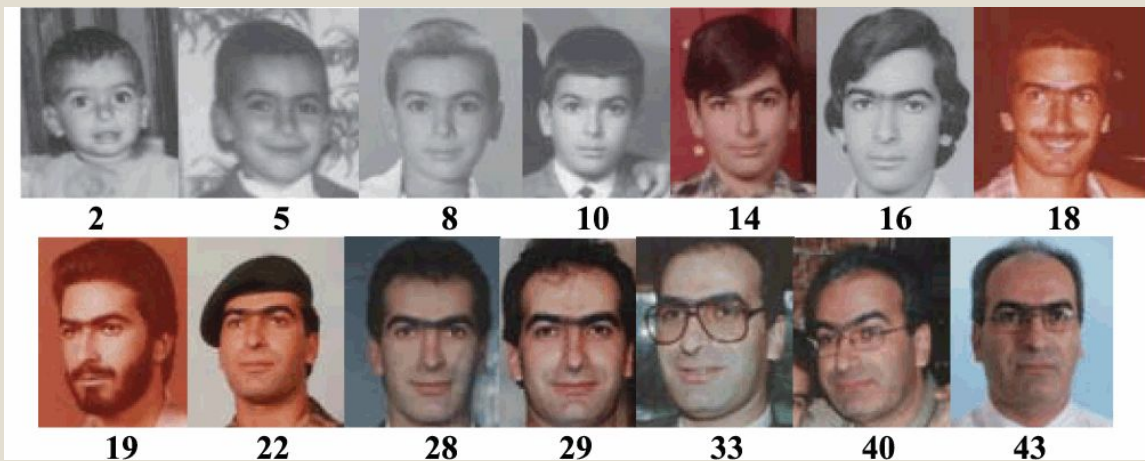
- As a person is getting older, facial blemishes such as freckles, age spots and fine wrinkles increase on the face skin.
- These micro-structures can be detected efficiently using LBP method.





# Method--Data

- FG-NET Aging Database
  - – 1002 face images
  - – 82 subjects
  - – Age: 0-69



# Method--preprocessing

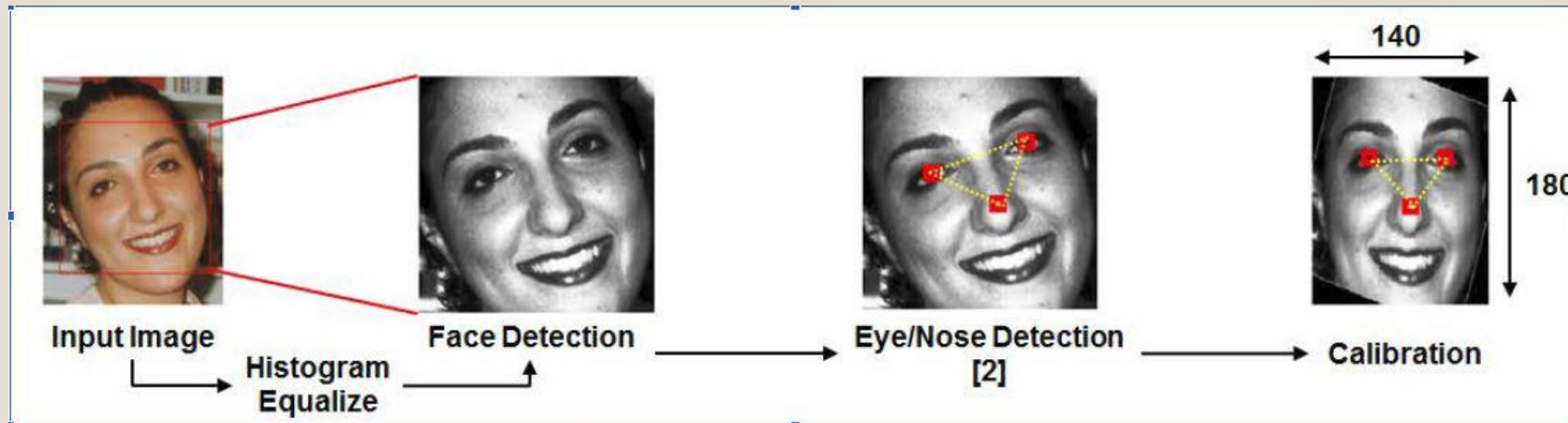
- Step 1: Face detection
- Step 2: Eye/nose detection ( pictorial structure model)



# Method--preprocessing

- Step 3: Calibration
- Rotation: eyes position (x1,y1),(x2,y2)
- Resizing 140x180

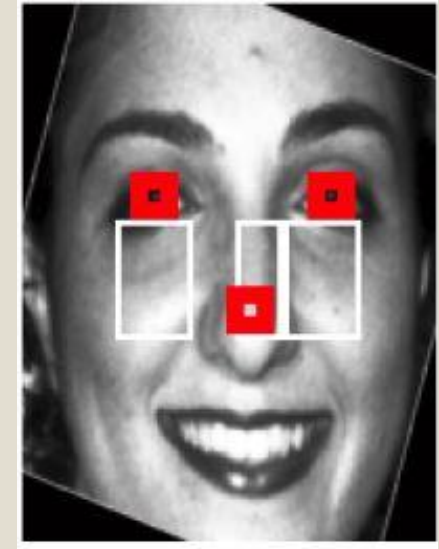
$$\theta = \tan^{-1}\left(\frac{y_1 - y_2}{x_1 - x_2}\right)$$



# Method--local region selection

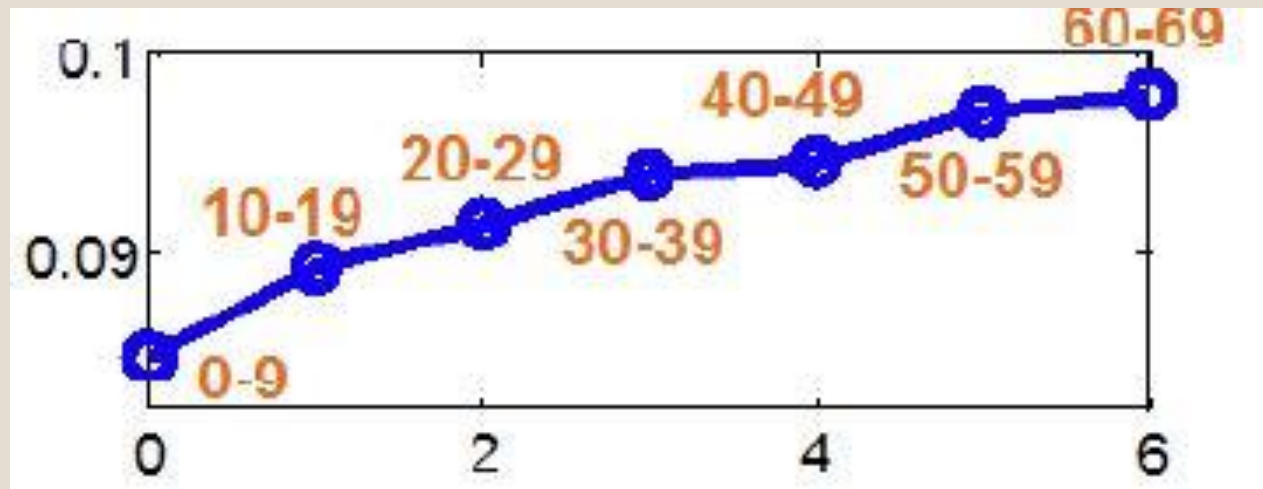
$$\begin{bmatrix} x_{rot} \\ y_{rot} \end{bmatrix} = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} \times \left( \begin{bmatrix} x \\ y \end{bmatrix} - \begin{bmatrix} x_{cent} \\ y_{cen} \end{bmatrix} \right) + \begin{bmatrix} x_{rot.cent} \\ y_{rot.cent} \end{bmatrix}$$

- Region 1:  $[(xc1 - 2):(xc1 + 1), (ycn : yc1 )]$
- Region 2:  $[(xc2 - 1):(xc2 + 2), (ycn : yc2 )]$
- Region 3:  $[xcn : (ycn : yc1 )]$



# Method--age regression

- Proportional relationship between age and LBP mean histogram
- Lasso regression
- 10 folds cross validation



# Results

Feature extraction	Regression model	Validation	MAE
PCA	Multi-instance regression	600/402	9.49
LBP(P=8, r=1)	LASSO Regression	10 fold cross validation	9.23
LBP(P=12, r=3)	LASSO Regression	10 fold cross validation	9.38

# Conclusion

- Proposed system using LBP can predict age
- Advantage:
  - easy to implement, computation efficiency, robust to variant images
- Disadvantage: limited pixel information used
- Further improvement can be done by integrating with gabor features

# References

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- [5], Choi, Sung Eun, et al. "Age Estimation Using a Hierarchical Classifier Based on Global and Local Facial Features." *Pattern Recognition*, vol. 44, no. 6, 2011, pp. 1262–1281., doi:10.1016/j.patcog.2010.12.005.
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