

Face Recognition System with Automatic Training Samples Selection Using Self-organizing Map

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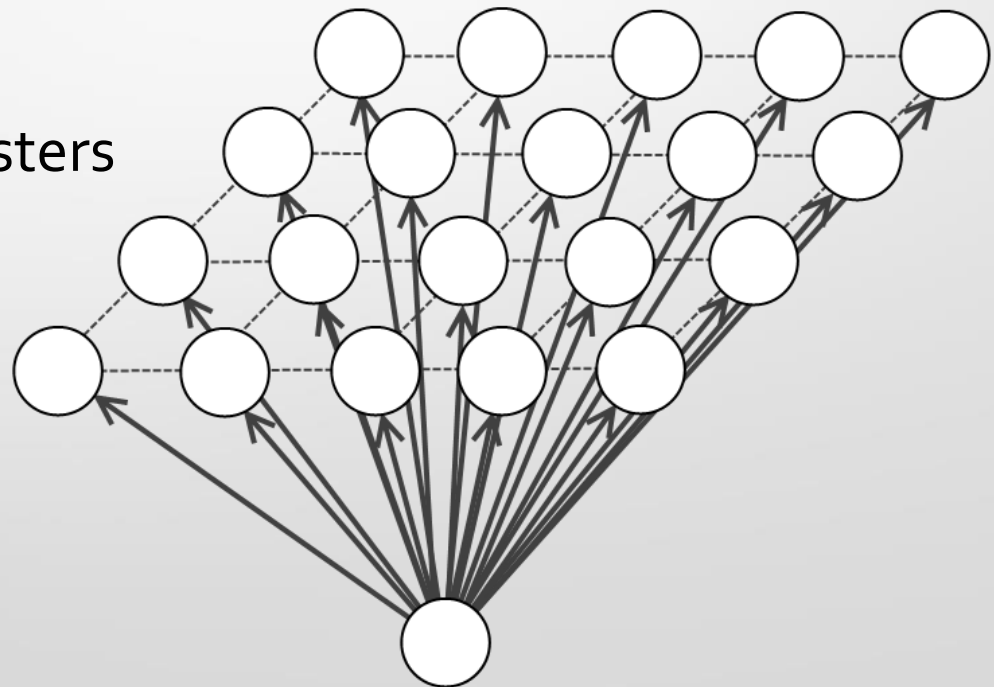


Motivation

- Face recognition – acceptability, collectability
- Commercial usage – common camera
 - About 30 frames per second
 - Able to save 300 images in only 10 seconds
 - Need to select training images
- Previous work – Elmar 2013
 - Evaluation of proposed training samples selection

Self-organizing map

- Neural network by T. Kohonen
- Clustering algorithm
- # of neurons = # of clusters



Input data

- CMU Pose, Illumination, Expression (PIE) face database
 - The database consists of 68 subjects, 13 different poses, 43 different illumination conditions, 4 different expressions.



Input data

- 5 different poses
 - Top row C09
 - Middle C05, C27, C29
 - Bottom C07
- Two sets
 - Set 1 – only middle row
 - Set 2 – all rows



Input data

- Pre processing
 - Conversion to grayscale, Geometric normalization, Resizing to 64×64 pixels
 - Histogram equalization (HE) or Contrast limited adaptive histogram equalization (CLAHE)



Previous work

- Set 1, CLAHE equalization



C05

C05

C27

C27

C29

C29

Previous work

- Set 2, CLAHE equalization



C05

C05

C05

C07

C27

C27

C27

C09

C29

Previous work

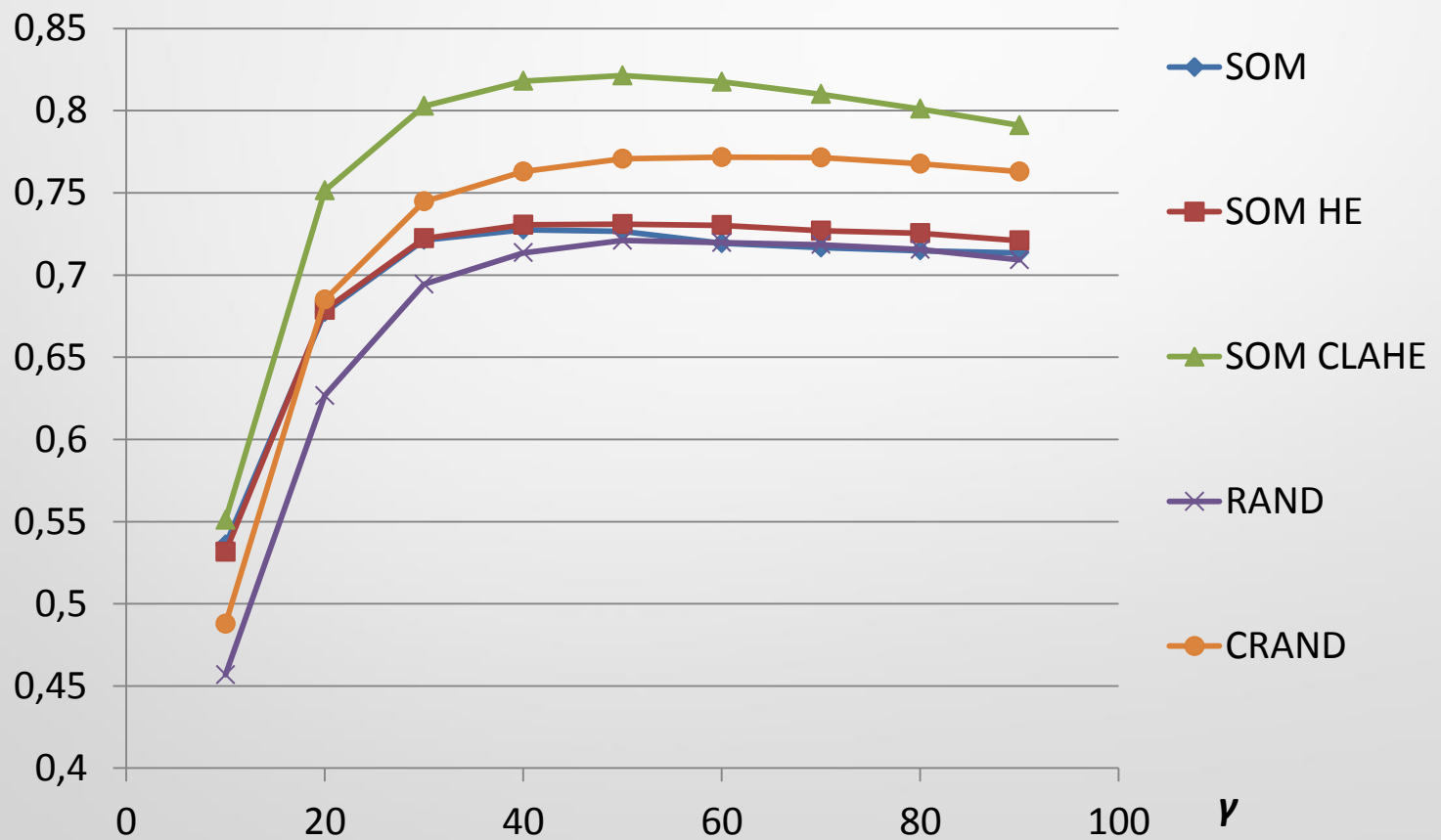
- Results for 68 subjects from the CMU PIE database
(average number of selected images)

	Pre-proc.	C05	C07	C27	C09	C29
Set 1	Basic pre-proc.	1.93	X	3.43	X	0.64
	HE	2.53	X	2.93	X	0.54
	CLAHE	2.26	X	2.57	X	1.17
Set 2	Basic pre-proc.	0.412	2.353	3.440	0.927	1.868
	HE	1.279	1.382	4.279	1.147	0.913
	CLAHE	1.720	1.573	2.882	1.119	1.706

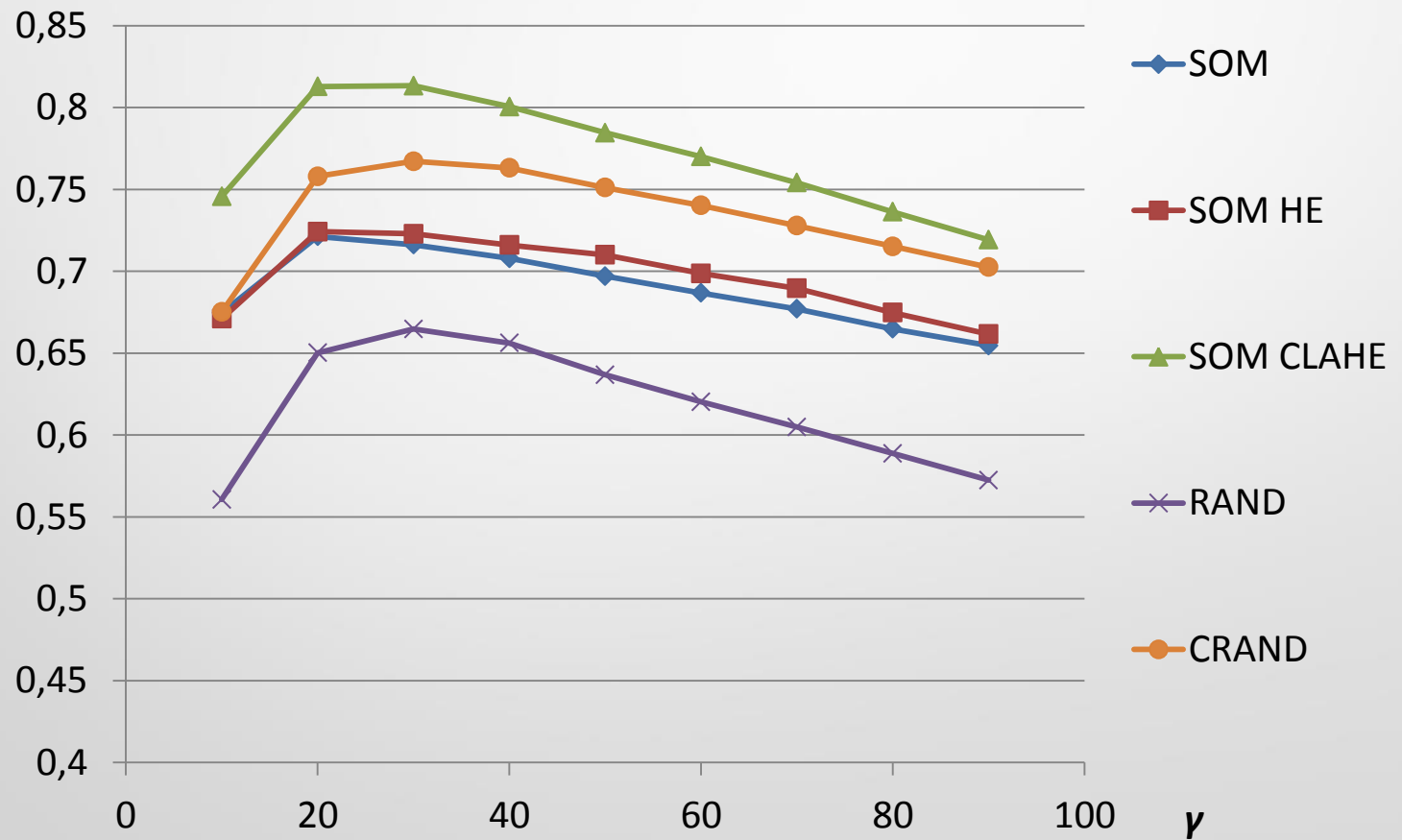
Evaluation of proposed method

- Recognition accuracy of face recognition system
 - One level system with SVM as a classifier
 - Two level system with PCA for feature extraction and SVM for classification
- Training samples selection
 - Random selection - RAND
 - Controlled random selection - CRAND
 - SOM
 - HE
 - CLAHE

Results – one level system



Results – two level system



Results

Recognition accuracy of face recognition systems with automatic training samples selection (max. recognition accuracy %)	Training samples selection method				
	Automatic selection SOM without contrast enhancement	Automatic selection SOM HE	Automatic selection SOM CLAHE	Controlled random selection CRAND	Uncontrolled random selection RAND
SVM	72.75	73.09	82.13	77.16	72.10
PCA + SVM	72.13	72.42	81.33	76.72	66.47

Conclusion

- SOM - better recognition accuracy in face recognition systems
- Assumption - equal number of images from each pose would give the best results - not really correct
 - CRAND only 77.16 % in one-level system and 76.72 % in two-level system
- Self-organizing map without any additional control of samples offers the best results



Thank you

Questions?

For further information please contact us at
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