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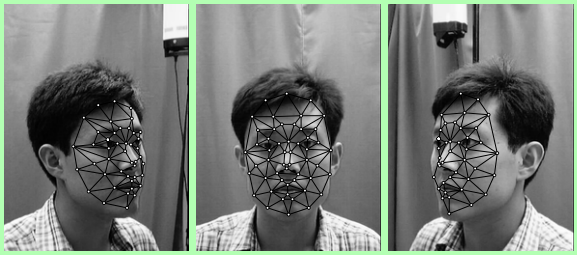
Learning invariances from examples

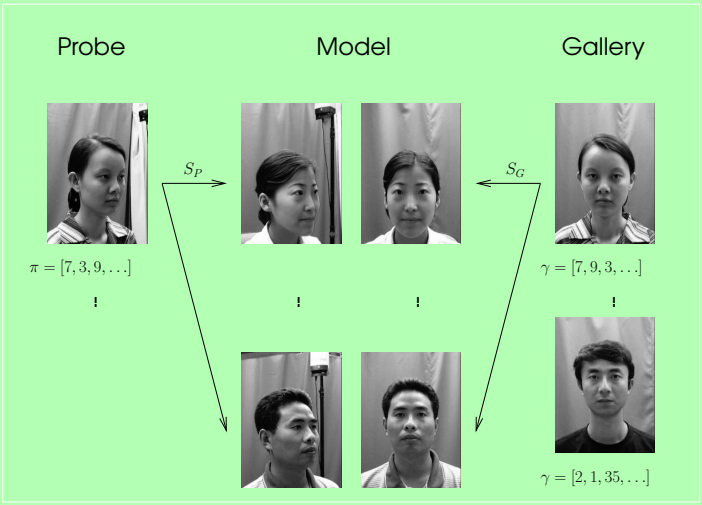
A major difficulty of standard neural network models is that their generalization is difficult to control. For cognitive tasks, generalization should be learnable from examples. In this poster, we present a method based on rank list similarities that learns invariance under pose and illumination for face recognition on the basis of examples with a limited amount of people. The generalization to persons only known only in standard pose and illumination achieves recognition rates of 99% for pose and 89% for illumination, a radical improvement over previous results on the same database.

Bunch Graph Matching (5)

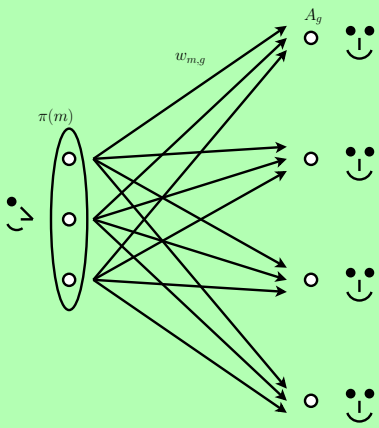


PM+45 PM+00 PM−45

Similarity rank lists (2)

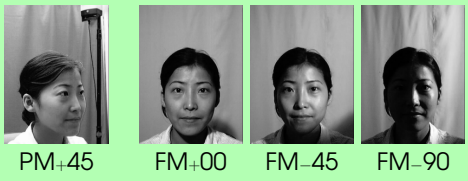


Neural network (4, 3)



$$
\begin{aligned}
w_{m,g} &= \frac{1}{N_M} \exp\left(\frac{\gamma_g(m)}{\lambda}\right) \\
A_g &= \sum_m \exp\left(\frac{\pi(m)}{\lambda}\right) w_{m,g} \\
&= \frac{1}{N_M} \sum_m \exp\left(\frac{\pi(m) + \gamma_g(m)}{\lambda}\right) \\
&= S_{neural}(\gamma_g, \pi) \\
g_{rec} &= \arg\max_g \frac{1}{N} \sum_n S_{neural}(\gamma_{g,n}, \pi_n)
\end{aligned}
$$

Examples



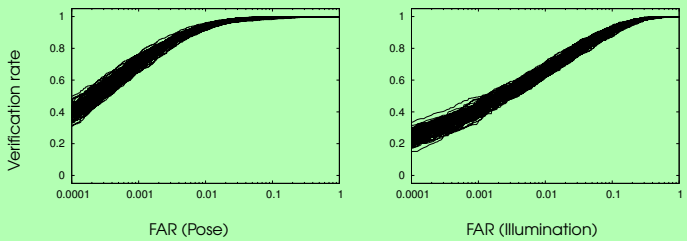
PM+45 FM+00 FM−45 FM−90

PM+00 FD+00 FD−45 FD−90

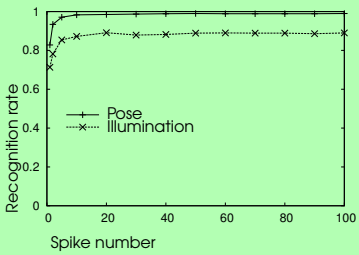
Recognition rates

	Pose	Illumination
Recog. rate (RR) with given situation	.9902	.8901
Rate of correct situation estimation	.9989 ± .0009	.9196 ± .0089
RR with autom. determined situation	.9775 ± .0050	.8997 ± .0136
Best RR reported in (2)	.9900	—
Best RR reported in (1)	.71	.51

ROC Curves



Early stopping



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References

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