3D computer vision system for face recognition

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GraphiCon-99, *August 31*

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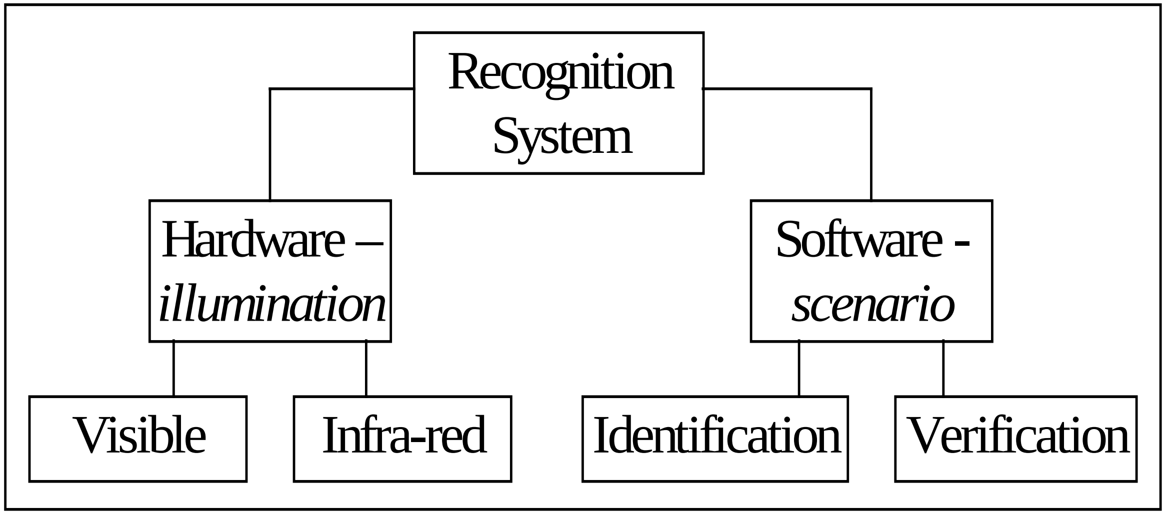

General structure of person recognition systems "Citadel"

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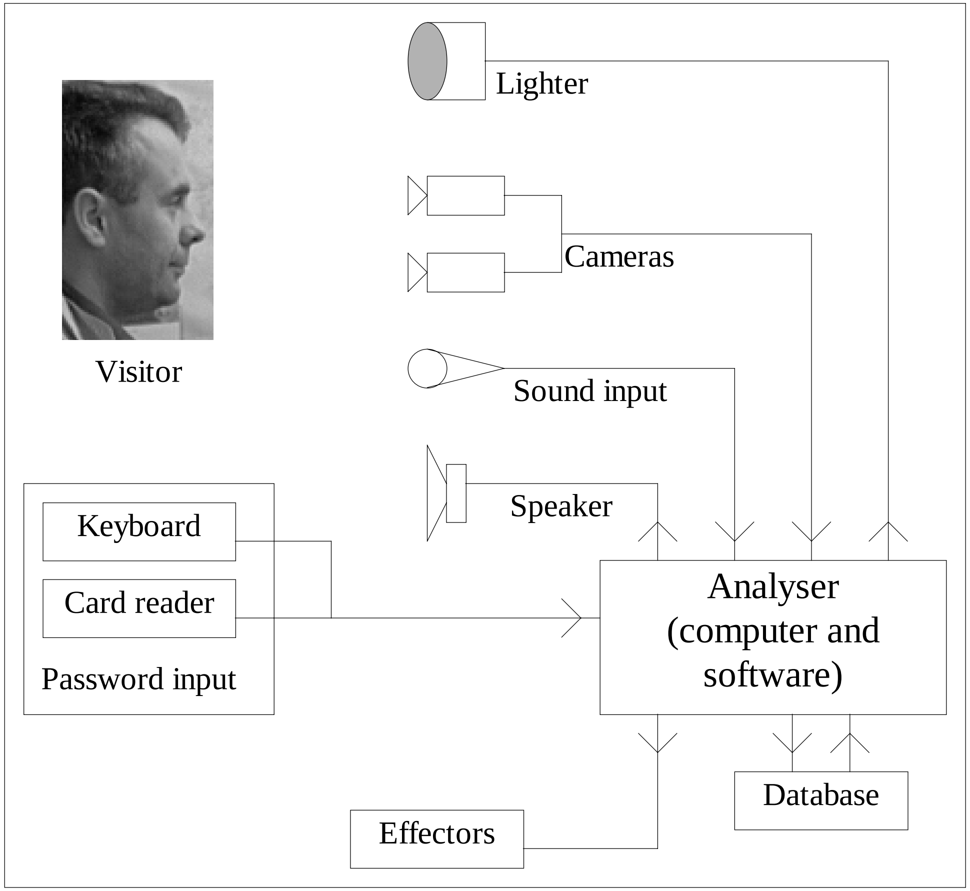

Possible components of system

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Appearance of Visible range model

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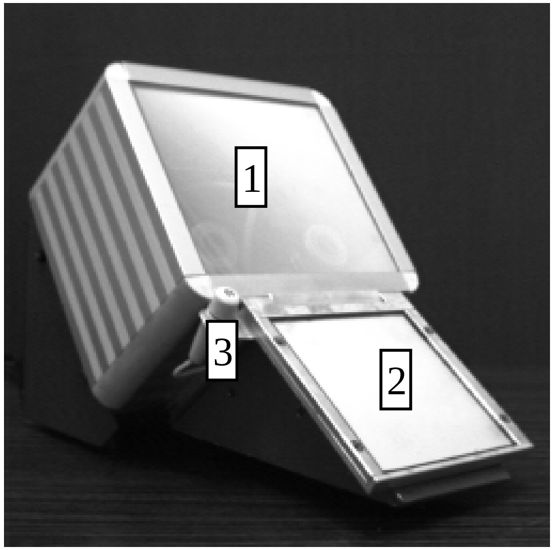

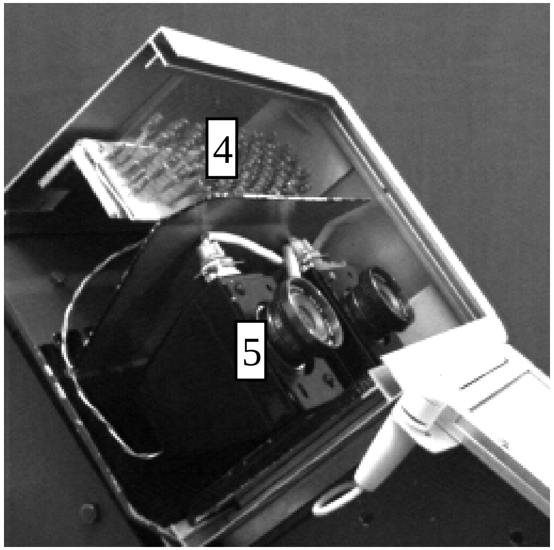

Infrared range model

1 *front panel mirror*, 2 *additional mirror*, 3 *microphone*, 4 *lighter*, 5 *camera*

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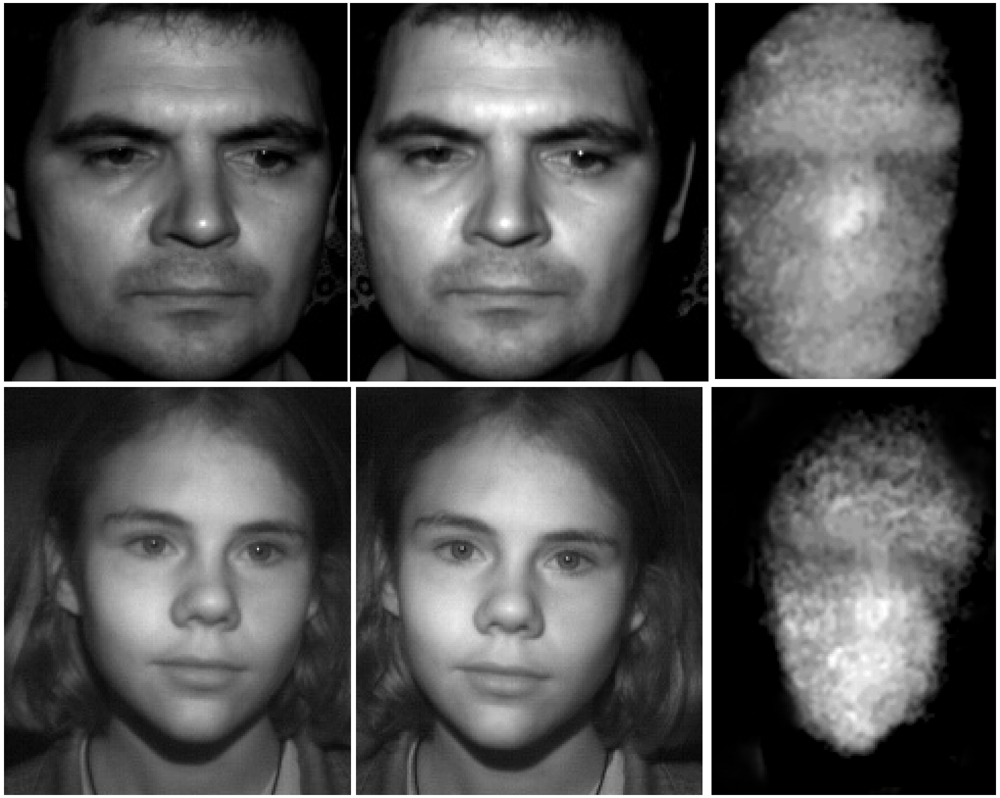

Source stereo-images and results of 3-D reconstruction algorithm

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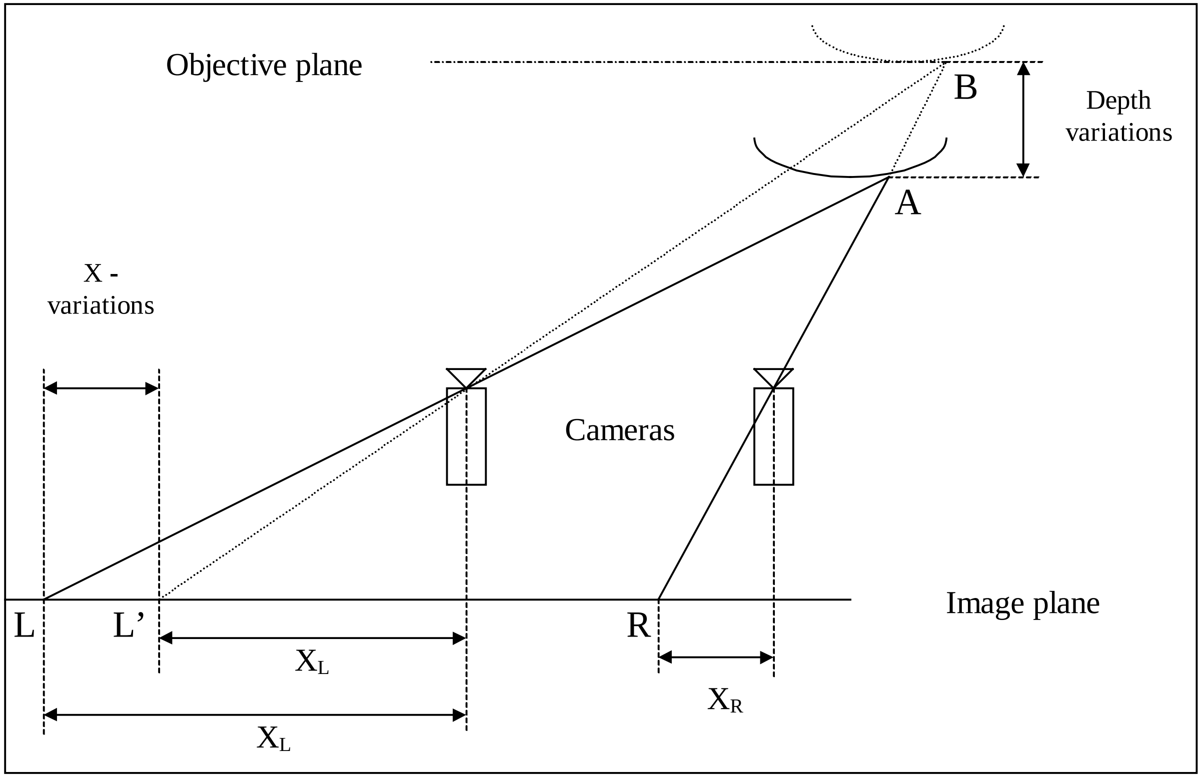

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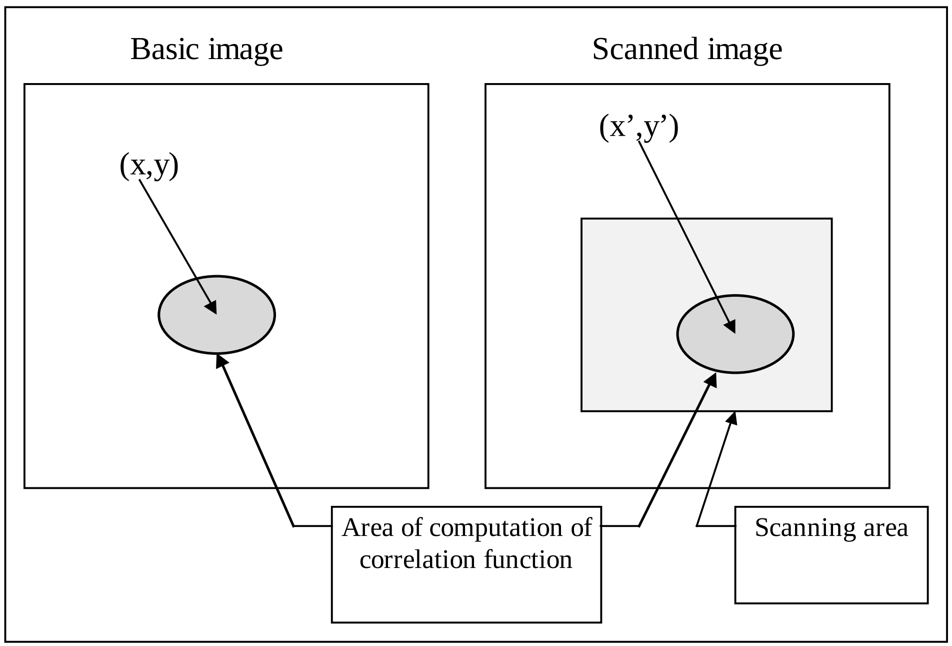

Correlation functions:

$$\Re_1(f,g) = \sum_{x_i \in \Omega_1, y_i \in \Omega_2} f(x_i) * g(y_i)$$

$$\Re_2 = \sum_{x_i \in \Omega_1, y_i \in \Omega_2} \left| (f(x_i) - M_f) - (g(y_i) - M_g) \right|$$

$$\Re_3 = \sum_{x_i \in \Omega_1, y_i \in \Omega_2} \left| (f(x_i) - M_f) - (g(y_i) - M_g) \right|$$

Corresponding points:

$$(x\copyright, y\copyright) = \arg \max_{(x\copyright, y\copyright) \in \Omega} \tilde{\Re}(\omega_L, \omega_R(x\copyright, y\copyright))$$

Depth computation:

$$Z = (L * W)/(B * N)$$

Computation of elevation maps

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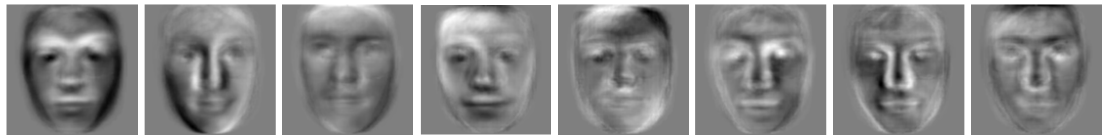
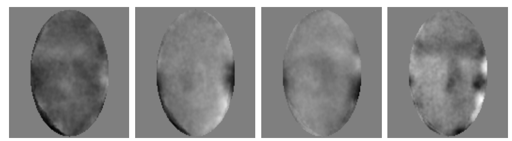
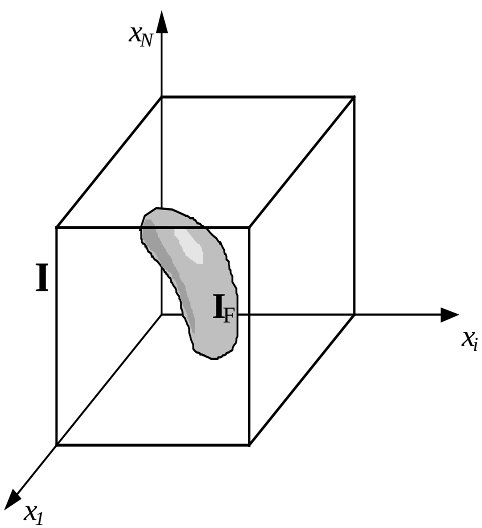
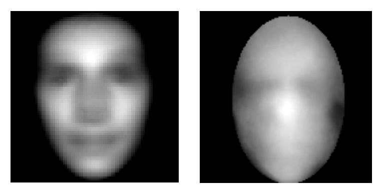


First eigenvectors of photo-images – principal components.



First eigenvectors of elevation maps – principal components





Mean vectors of training sets of photo-images and elevation maps respectively

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Combined measure:

$$\frac{1}{R^2(c,k)} = \sum_i W_i \frac{1}{\min\limits_{j_k} \left[R_i^2 (c_i, v_i^{j_k}) \right]} \qquad W_i = D_i \frac{D_i}{D_i^c}$$

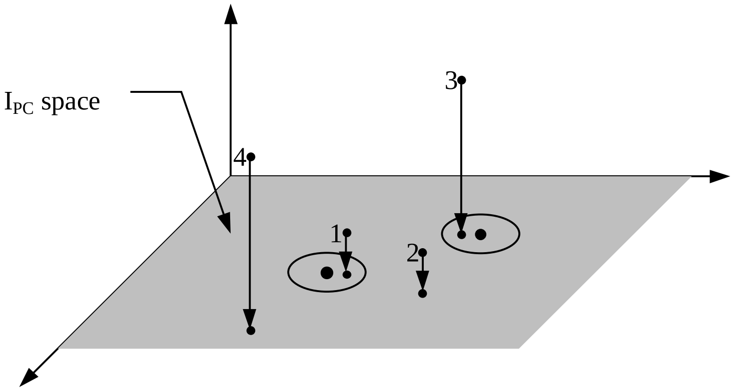
C - compound image, R -Euclidean distance,

D - dispersion, v^k – training set

Decision rule:

$$N = \arg\min \left\{ R(c, v^1), \ldots, R(c, v^K), T \right\}$$

	PC Space I_{PC}	Known images	Decision
1	near	Near	Is a known object
2	near	Far	Is an unknown object
3	far	Near	Is not an object of given variety
4		Far	



Possible situations for vector in image space

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Conclusion

System was tested on the database of about 600 stereo-images of 200 persons

Recognition accuracy achieved was about 95%

This is about two times more reliable than using simple photo-images