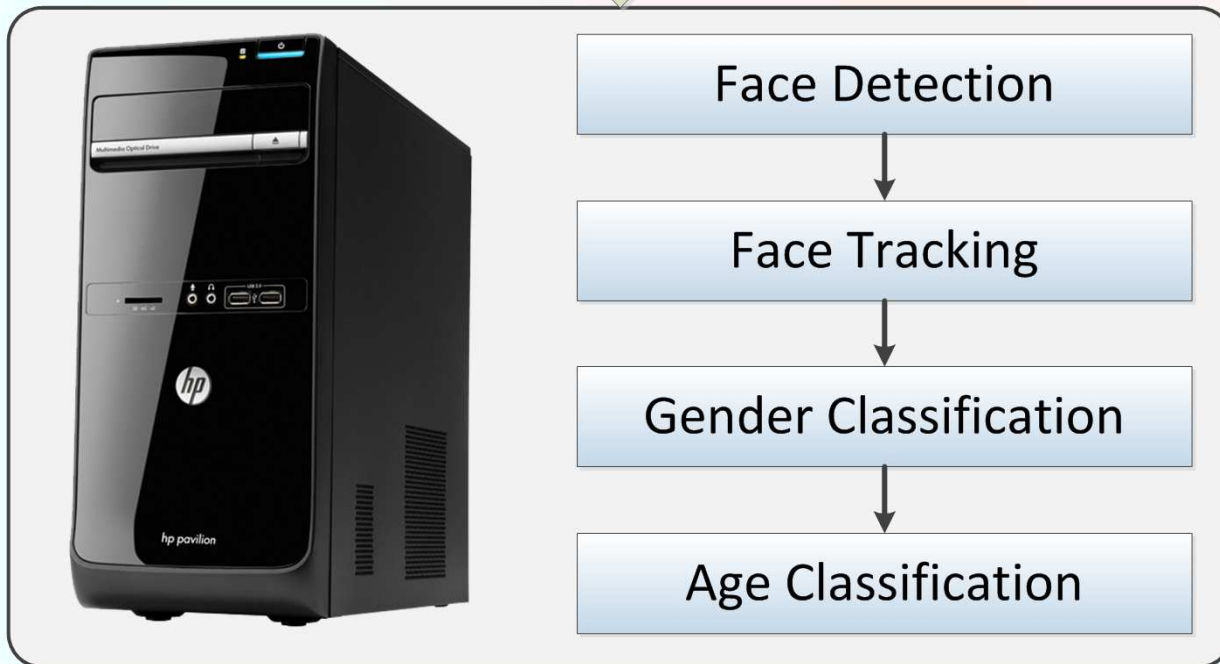
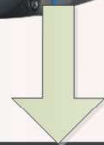




GENDER RECOGNITION VIA FACE AREA ANALYSIS

Vladimir Khryashchev

27 Faces



Face Detection



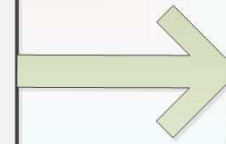
Face Tracking



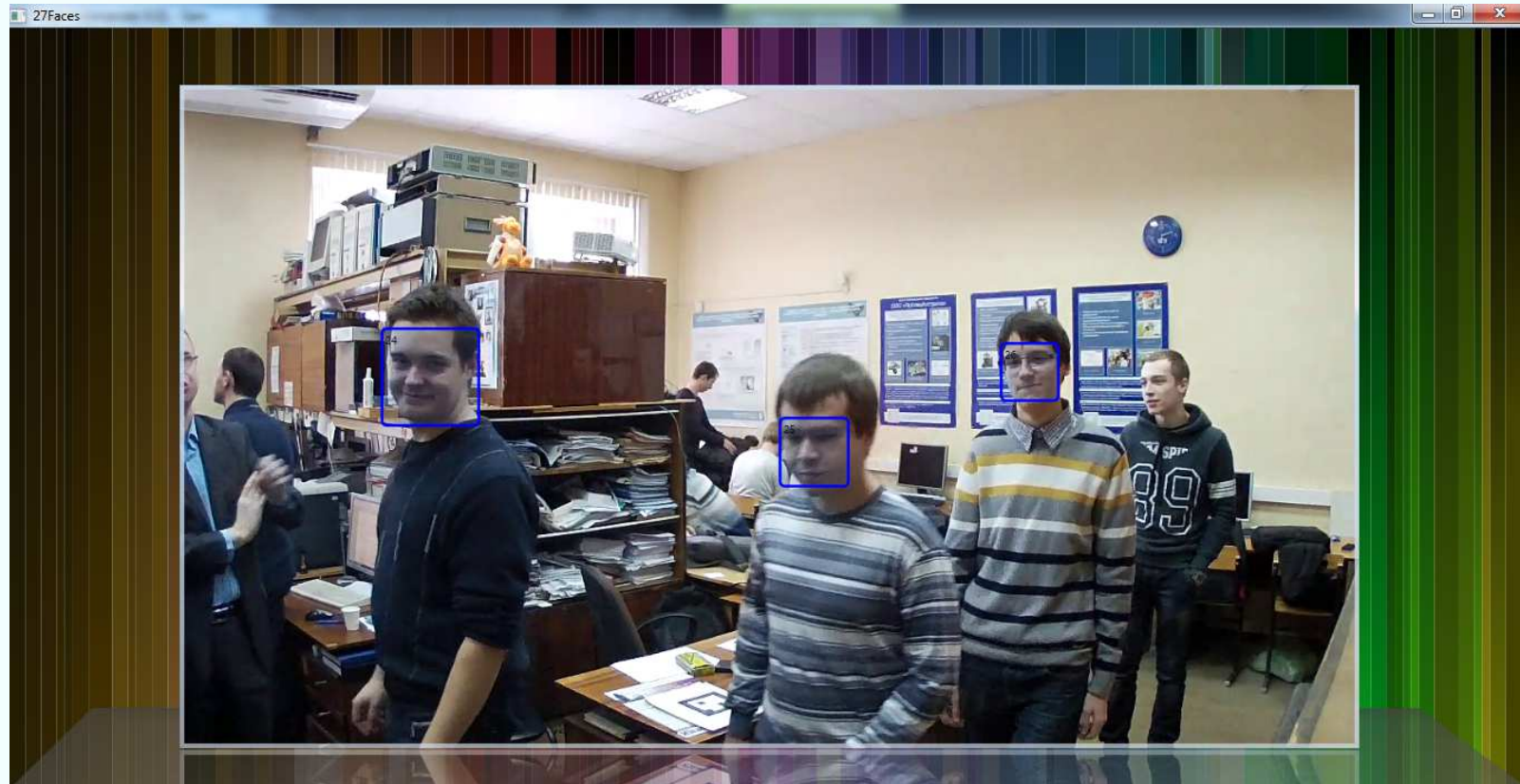
Gender Classification



Age Classification



27 Faces



Счетчик кадров: 3544 FPS: 17 Без лиц: 152 (4%) М: 11 Ж: 1 Всего: 15

- **human-computer interaction**
- **video surveillance**
- **web search**
- **digital signage**

Automatic Gender Recognition

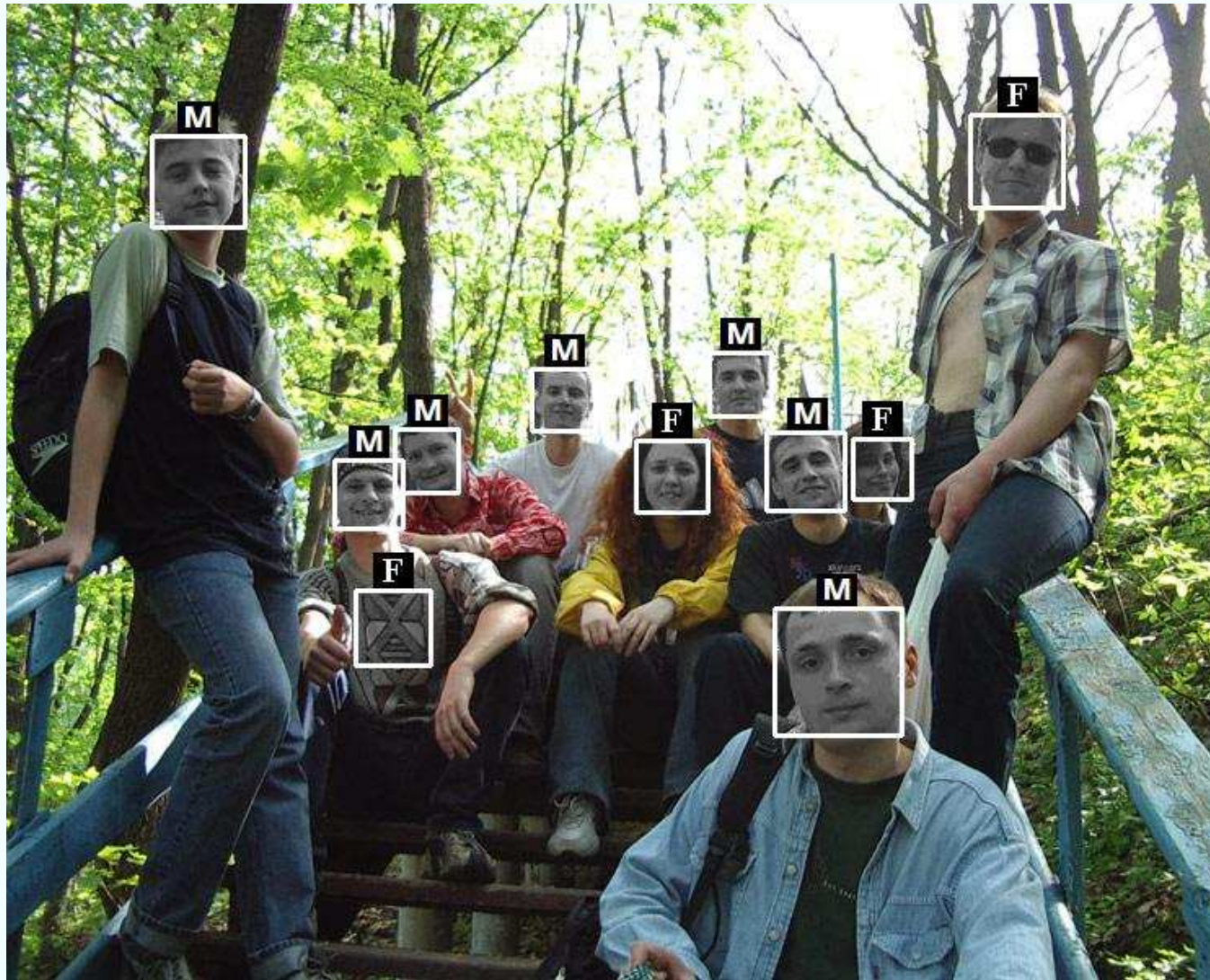


Image Dataset

The Proposed Training and Testing Database Parameters

Parameter	Value
The total number of images	8 654
The total number of male faces	5 250
The total number of female faces	5 250
Minimum image resolution	640×480
Color space format	RGB
Face position	Frontal
Lighting conditions, background	No restrictions
People's age	From 18 to 65 years old
Race	Caucasian

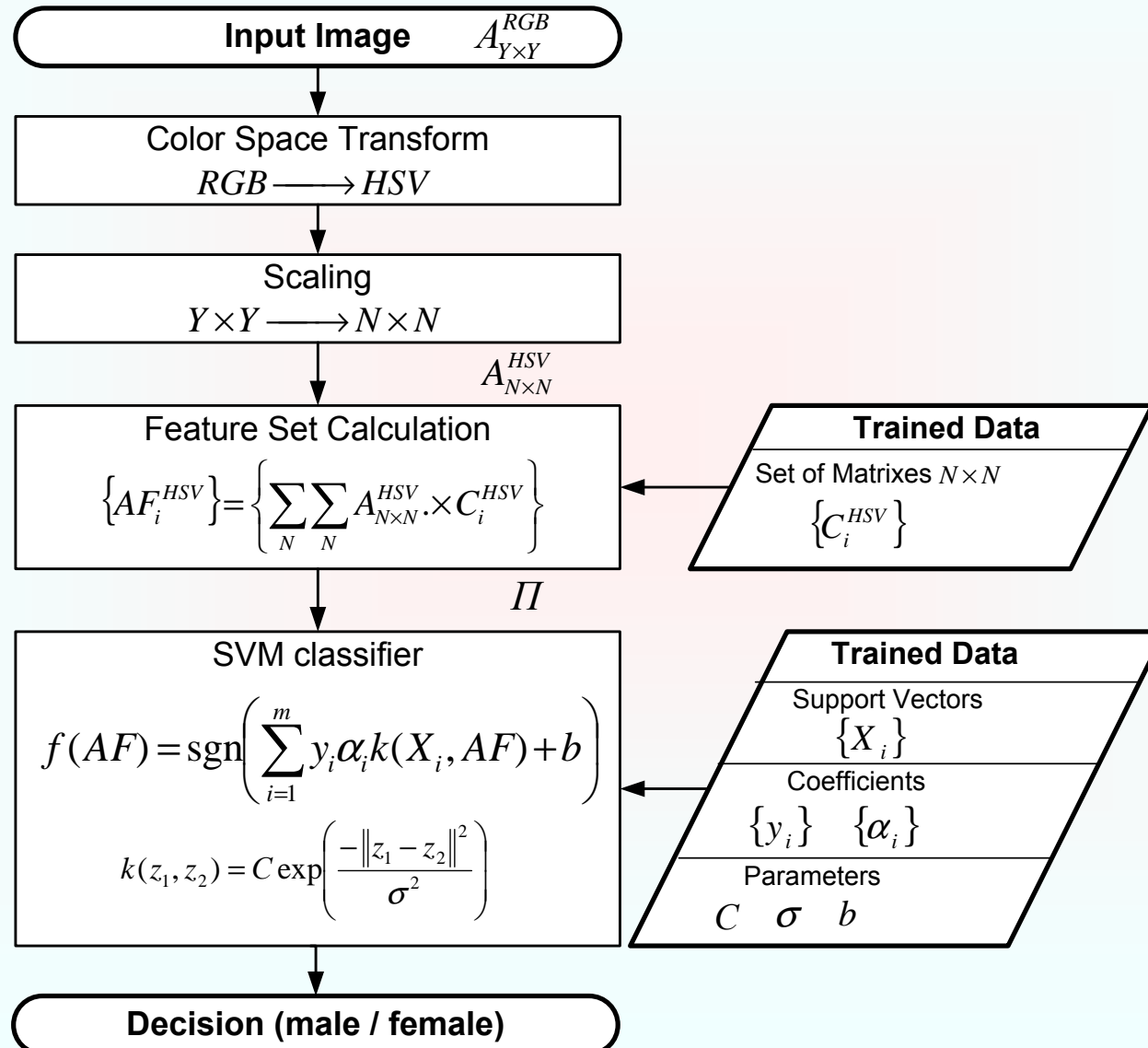
Male



Female



Gender Classification Algorithm by Adaptive Features

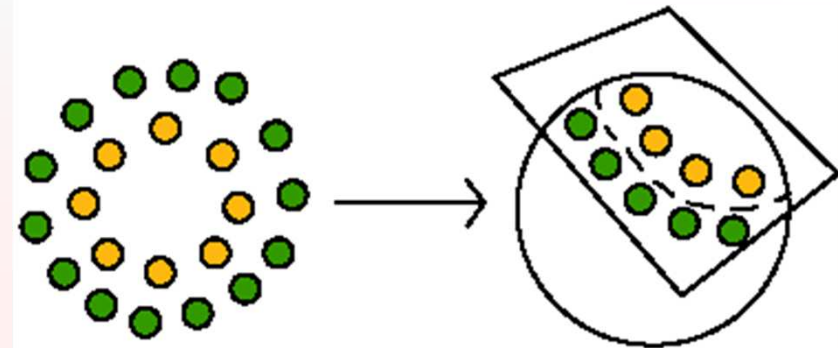


SVM Classifier

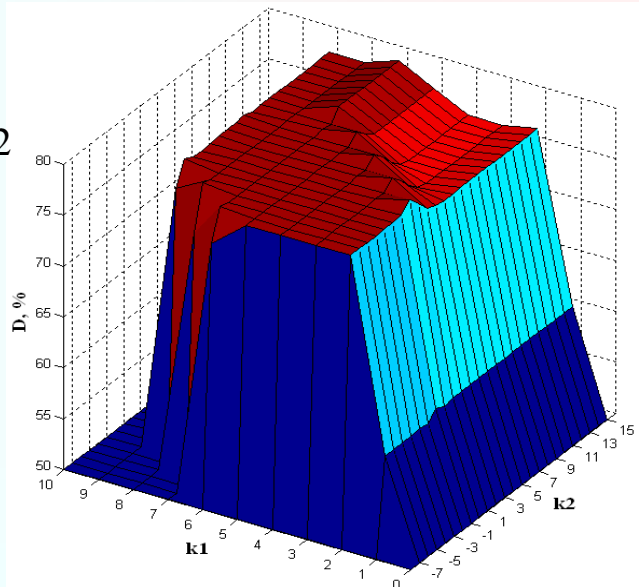
Linear classifier using kernel transformation to introduce nonlinearity:

$$k(z_1, z_2) = C \exp\left(\frac{-\|z_1 - z_2\|^2}{\sigma^2}\right)$$

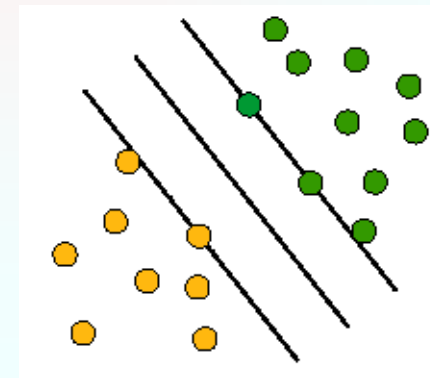
Gauss kernel function



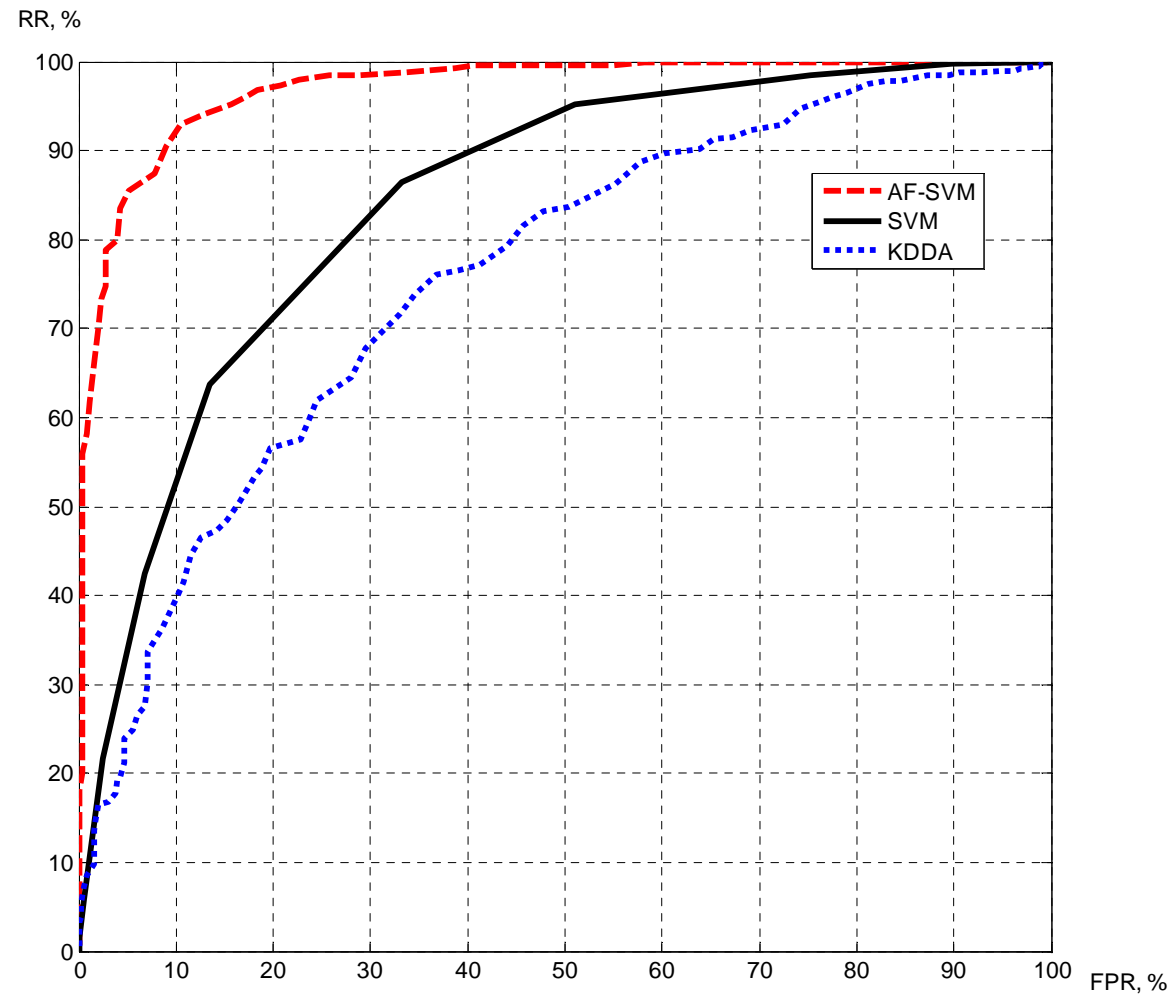
$$C = 10^{k1}$$
$$\sigma = 10^{k2}$$



$$f(X) = \text{sgn}\left(\sum_{i=1}^m y_i \alpha_i k(X_i, X) + b\right)$$



AF-SVM Classification Results



ROC-curves of tested gender recognition algorithms

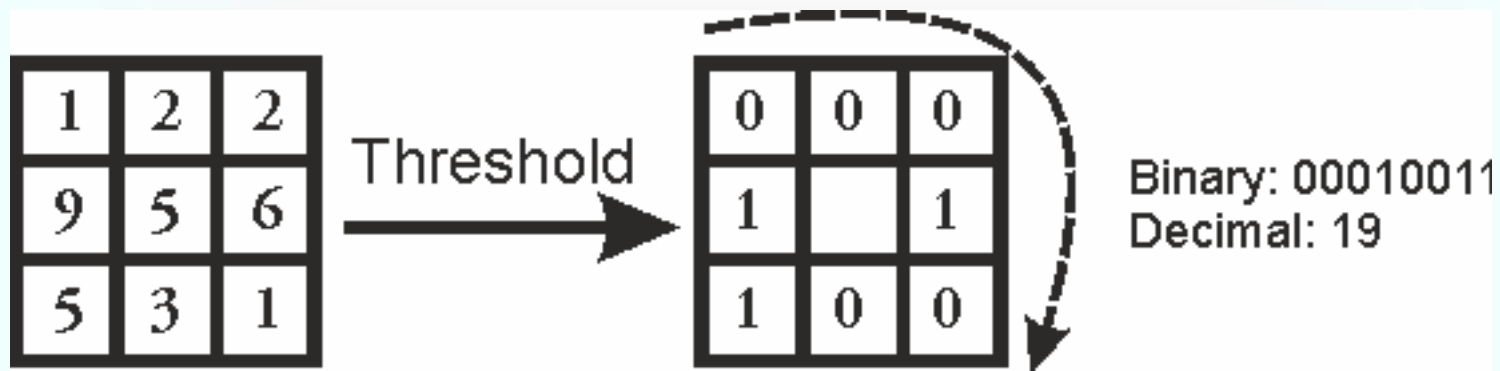
AF-SVM Classification Results

Comparative Analysis of Tested Algorithms Performance

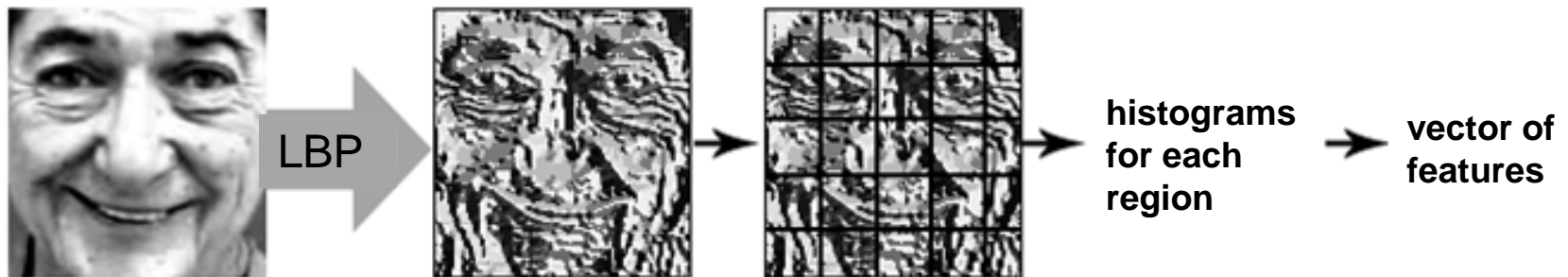
Algorithm	SVM		KDDA		AF-SVM	
Parameter						
Recognition rate	True	False	True	False	True	False
Classified as "male", %	80	20	75.8	24.2	90.6	9.4
Classified as "female", %	75.5	24.5	65.5	34.5	91	9
Total classification rate, %	77.7	22.3	69.7	30.3	90.8	9.2
Operation speed, faces / sec	44		45		65	

Local Binary Patterns

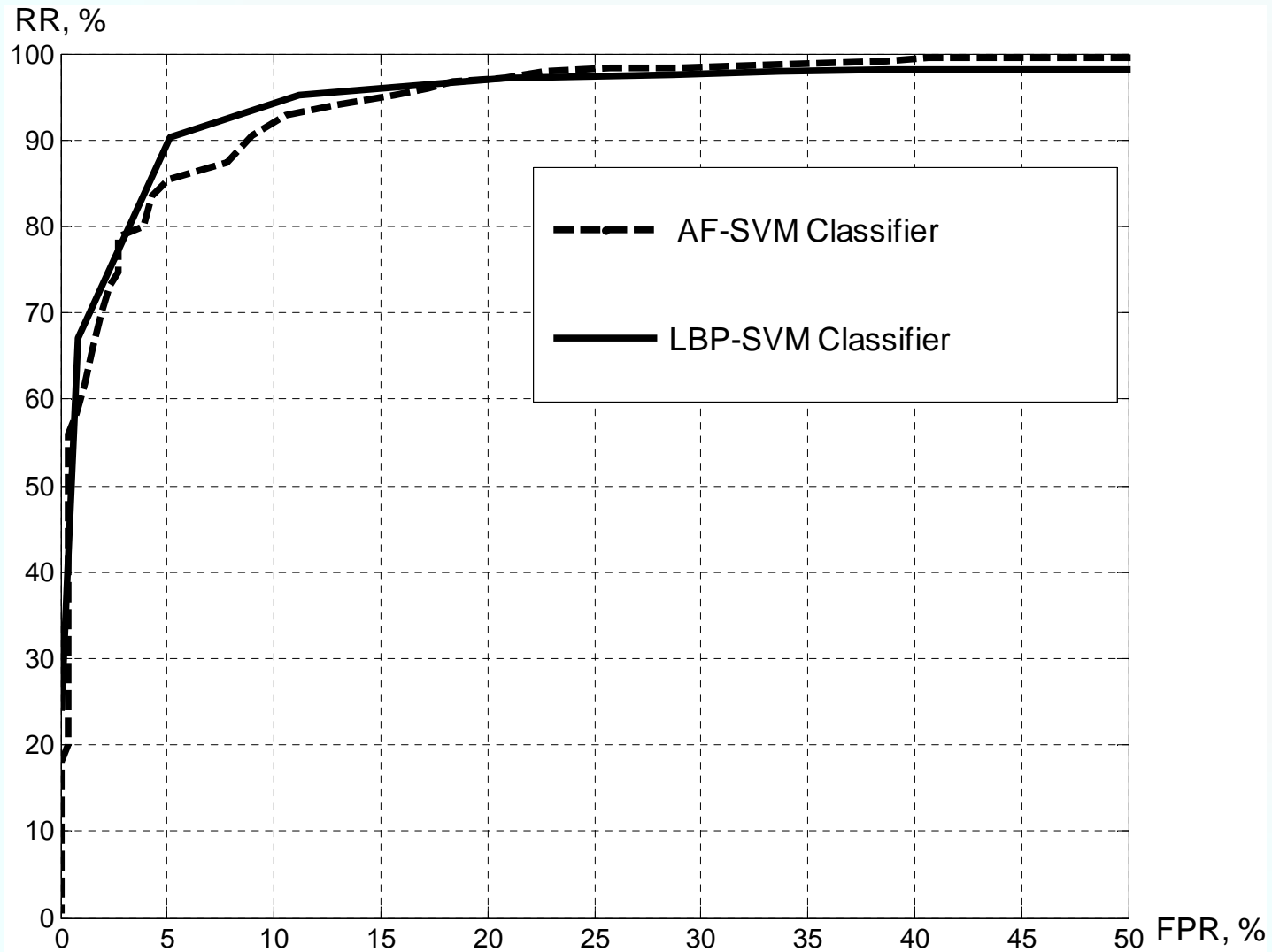
Operator applied to each pixel



Calculation of histograms for each region



LBP Classification Results



AF-SVM	
True	False
90,6	9,4
91	9
90,8	9,2

LBP-SVM	
True	False
90,2	9,8
94,3	5,7
92,3	7,7

Combine Classification Results

Algorithm	AF-SVM		LBP-SVM		Combine	
Parameter						
Recognition rate	True	False	True	False	True	False
Classified as "male", %	92.7	7.3	90,4	9.6	96.6	3.4
Classified as "female", %	89.9	10.1	90,1	9.9	96	4
Total classification rate, %	91.3	8.7	90.2	9.8	96.3	3.7
Unclassified, %	0		0		12	

Conclusions

- **Two gender classification algorithms were proposed: AF-SVM and LBP-SVM.**
- **AF-SVM has recognition rate 90.8% with operation speed 65 faces/sec.**
- **LBP-SVM gender classification algorithm improves recognition rate up to 92.3%.**
- **The combined use of both algorithms improves recognition rate up to 96.3% with 12% unclassified faces.**



Thank you for your attention !!!

Vladimir Khryashchev