Nonintrusive human's functional state monitoring system

A.B. Kogan Research Institute
for Neurocybernetics
KRINC
Rostov-on-Don, Russia

A. Vtyurina, S. Anishchenko, M. Petrushan
sasha.vtyurina@gmail.com

Faculty of Mathematics, Mechanics
and Computer Science,
Southern Federal University,
Rostov-on-Don, Russia

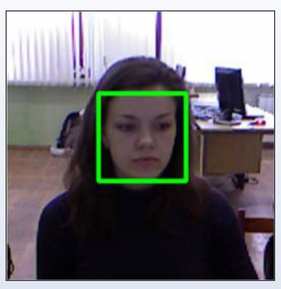
Abstract

The overall aim of this research is to investigate correlation between visual features and human's functional state, i.e. level of fatigue, alertness.

Motivation

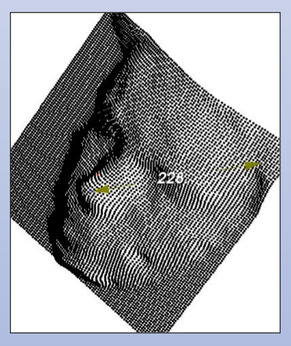
Nowadays the number of automatic devices has increased dramatically comparing to those of the previous decade. Great responsibility lies with those people who control machines. Such a routine job may eventually decrease the alertness level, which in its turn may cause accidents. Any human monitoring system should not make people feel uncomfortable. From here we got the idea of creating a system which will allow us to accomplish nonintrusive human state control while working.

Feature detection

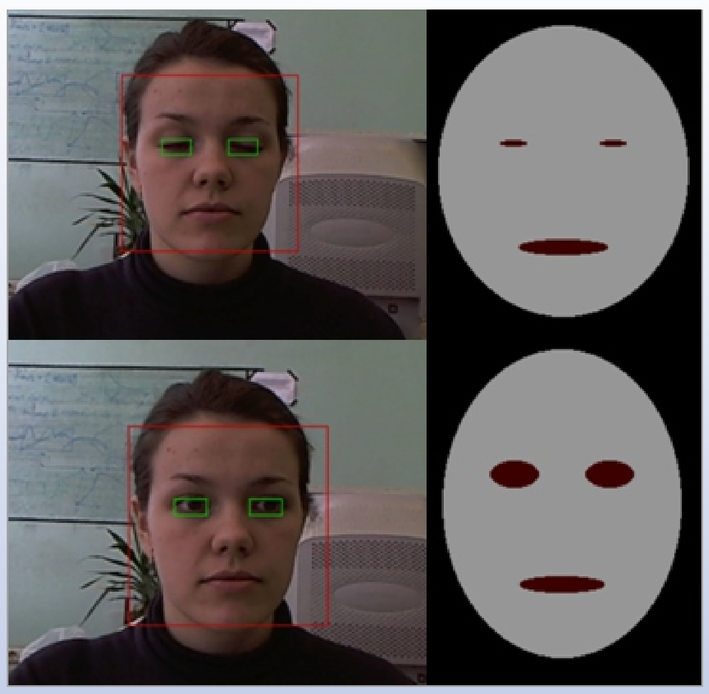


RGB picture is used to find face location with Viola-Jones algorithm.

RGB picture and depth map from Kinect sensor are put together in order to get depth map of face area.



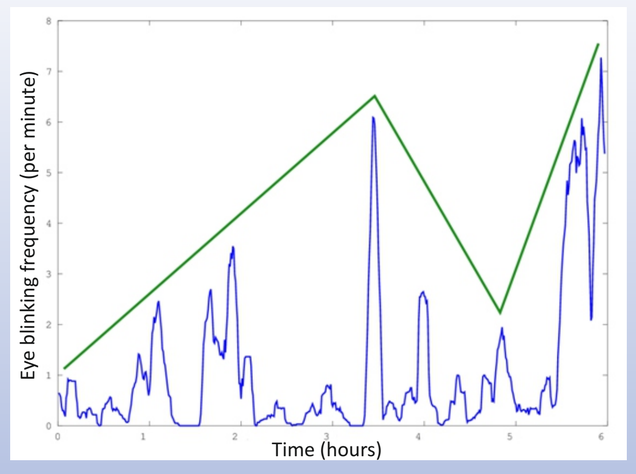
Using the Point Cloud Library 3D face model is built.



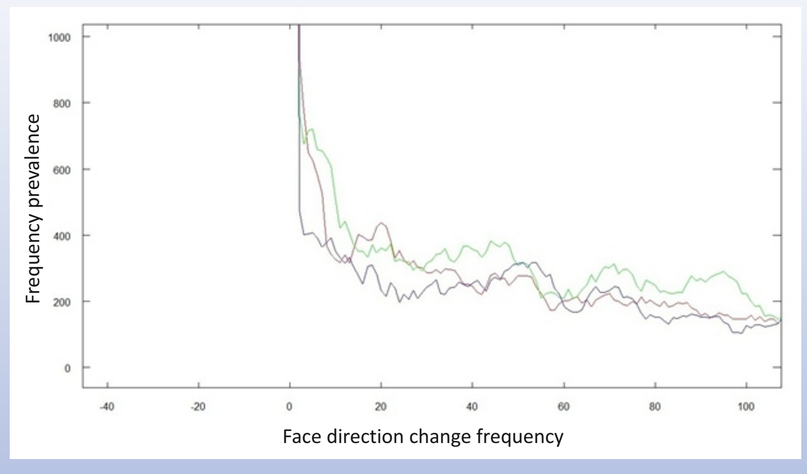
RGB picture is used to locate face and eyes. k-NN and HOG are used to recognize the state of an eye – whether it is open or closed.

Using heuristic algorithms we estimate head orientation and position. We compute vector directed from the head center to nose tip.

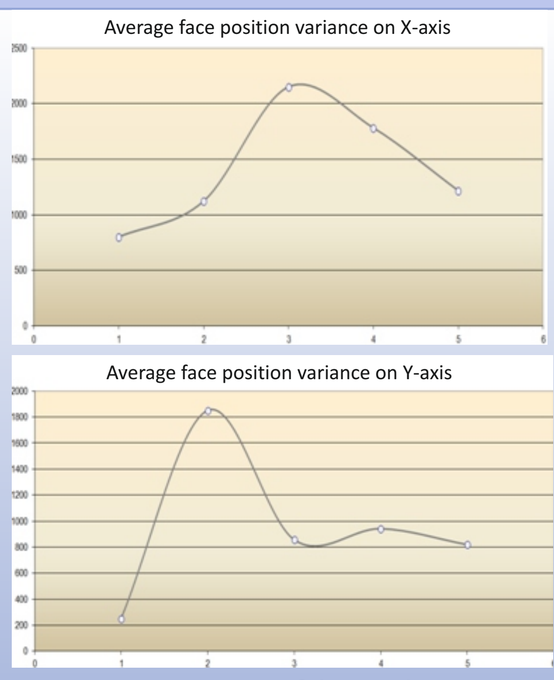
Finding correlation



Blinking frequency grows when fatigue occurs. Maximum peaks occur before lunch time and at the end of the day.



Correlation between fatigue and face direction change frequency was found with the help of spectral analysis. Different frequency prevails in different periods.



Low variance of head position distribution at the beginning and at the end of the day.

Conclusion

The results obtained show the correlation between visual facial features and human functional state. Having used this features it is possible to create a human functional state monitoring system.