

# Vision-based prevention of work-related disorders in computer users

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## Motivation

- The number of computer-related jobs is increasing rapidly:
  - 40% of workers in EU use computers in daily work
  - 70% of computer workers worldwide have vision problems
- Computer use is related with:
  - vision problems: Computer Vision Syndrome
  - prolonged sedentary work
  - static work
  - Carpal Tunnel Syndrome
  - Repetitive strain injury
  - Cumulative trauma disorder
- Most disorders can be avoided by preventive measures
- It is difficult to follow health guidelines when you're focused on work!



## Proposed solution

- Intelligent monitoring of computer user's behaviour:
  - observing the user at his workplace by a webcam
  - analyzing his activities and behaviour
  - detection & analysis of eye-blinks
  - body movement analysis
- Interactive warnings and exercises:
  - warnings of potentially dangerous working habits
  - instructions for appropriate relaxation
  - interactive physical exercises

## Constraints

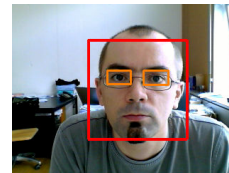
- Standard webcam as a video source
- High frame rate for eye-blink detection: 30 Hz
- Robustness to illumination changes
- Focus on upper body of a sitting person
- Conformation to relevant EU legislation regarding personal data protection

## Problems

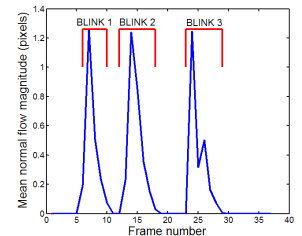
- Environmental illumination changes
- Extreme facial rotation
- Non-rigid body transformations
- Low image quality: 320 × 240 pixel input image gives approximately 32 × 18 pixel eye region
- How to distinguish between a blink and downwards gaze?
- ... and many, many more ...

## Vision-based behaviour analysis

- Eye-blink detection:
  - Face & eye detection (boosted classifiers)
  - Facial feature selection
  - 3D face pose estimation (affine correspondence)
  - Face & eye movement estimation (normal flow)
  - Eye movement analysis (frequency & duration)
- Additional properties:
  - Activity level
  - Unsymmetrical body posture
  - Repetitive movement patterns
  - On-screen / off screen gaze ratio



Face and eye detection



Eye movement analysis

## Vision-enhanced GUI

- Providing mental and muscular relaxation:
  - estimation of gaze direction
  - interactive exercises:
    - gaze controlled "games"
    - video-based supervision & evaluation
  - timely health risk warnings
  - pauses according to activity level
- Breaking the monotony at workplace
- Limiting repetitive movements

## Strategic impact

- Short term impact:
  - Immediate effect on user's behaviour at the workplace
  - Promoting guidelines for safe operation of computers
- Long term impact:
  - Prevention of computer work related disorders
  - Reduction of costs due to lower rates of illness and absence from work

## Contacts

Project web page:

<http://www.icg.tugraz.at/Members/divjak/prework>

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"PRE-WORK" project is supported by a Marie Curie Intra-European Fellowship within the 6<sup>th</sup> European Community Framework Programme (Contract No. 041395)

