Eye Tracking in Diagnosis of Vestibular Disorders

**The Vestibular System**
The vestibular system is located in the inner ear and is responsible for the sense of balance and spatial orientation. Since the sense of balance depends on integration of many kinds of information, a vestibular disorder can manifest itself in many ways such as falling, nausea, vomiting, and drowsiness. An accurate and inexpensive method must be available in order to evaluate different rehabilitation methods, to help develop treatments, and to assign certain treatments to different categories of dizzy patients.

**Vestibulo-Ocular Reflex (VOR)**
The VOR is activated by high speed rotation of the head and is responsible for correlating eye movements according to the head movements. In this way, the vision is stabilized and balance is maintained.

**Eye tracking**
The pupil position relative to the eye corners was extracted using an eye tracker.

**Eye model**
Knowing the position of the pupil and the eye corners, a geometrical model was used in order to extract the eye angle relative to the face angle.

**Active Appearance Model (AAM)**
The horizontal face angle and the position of the eyes in each frame were extracted using an AAM. Extraction of the angle was based on a linear relationship between parameters of the AAM and the angle.

**Results**
Eye and face angles were derived at different angular velocities of the head. Poor correlation of the eye movements at increasing velocities indicates a vestibular disorder.

**Conclusion**
It is possible to examine the functionality of the vestibular system using low cost recording equipment and an AAM based eye tracker.