DEPTH COMPENSATION MODEL FOR GAZE ESTIMATION IN SPORT ANALYSIS

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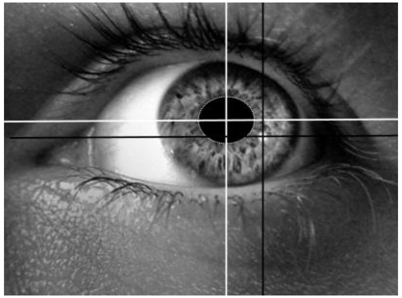
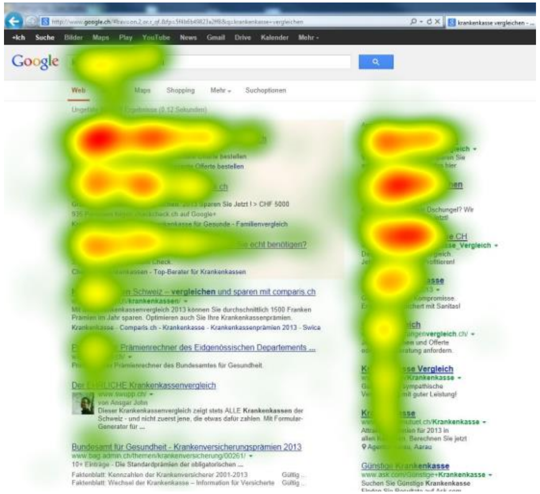
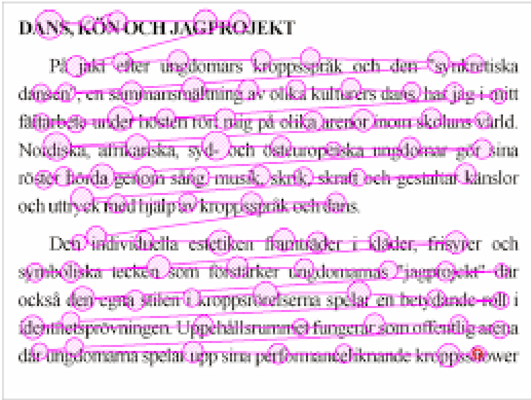
WHAT IS EYE TRACKING?

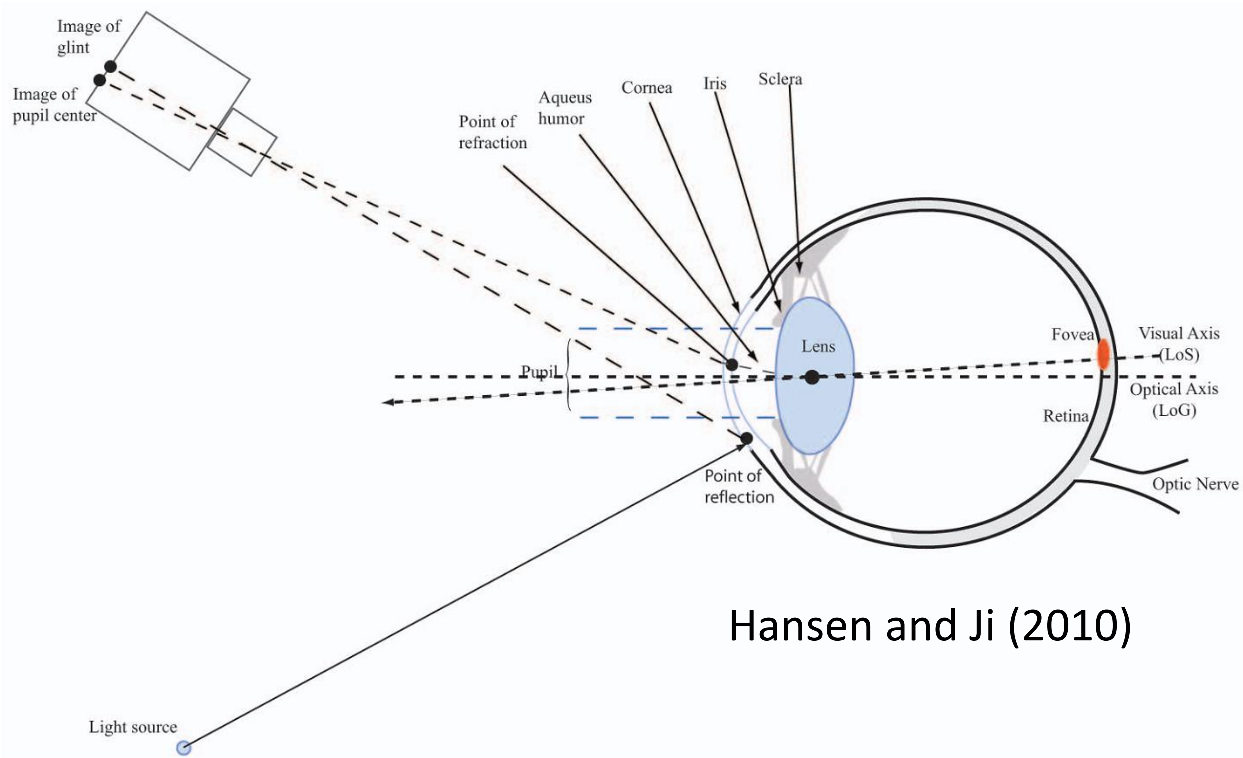




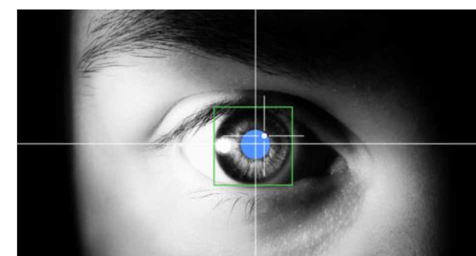


GAZE ESTIMATION PROCESS

Ocular parameters analyzed by the gaze estimation method

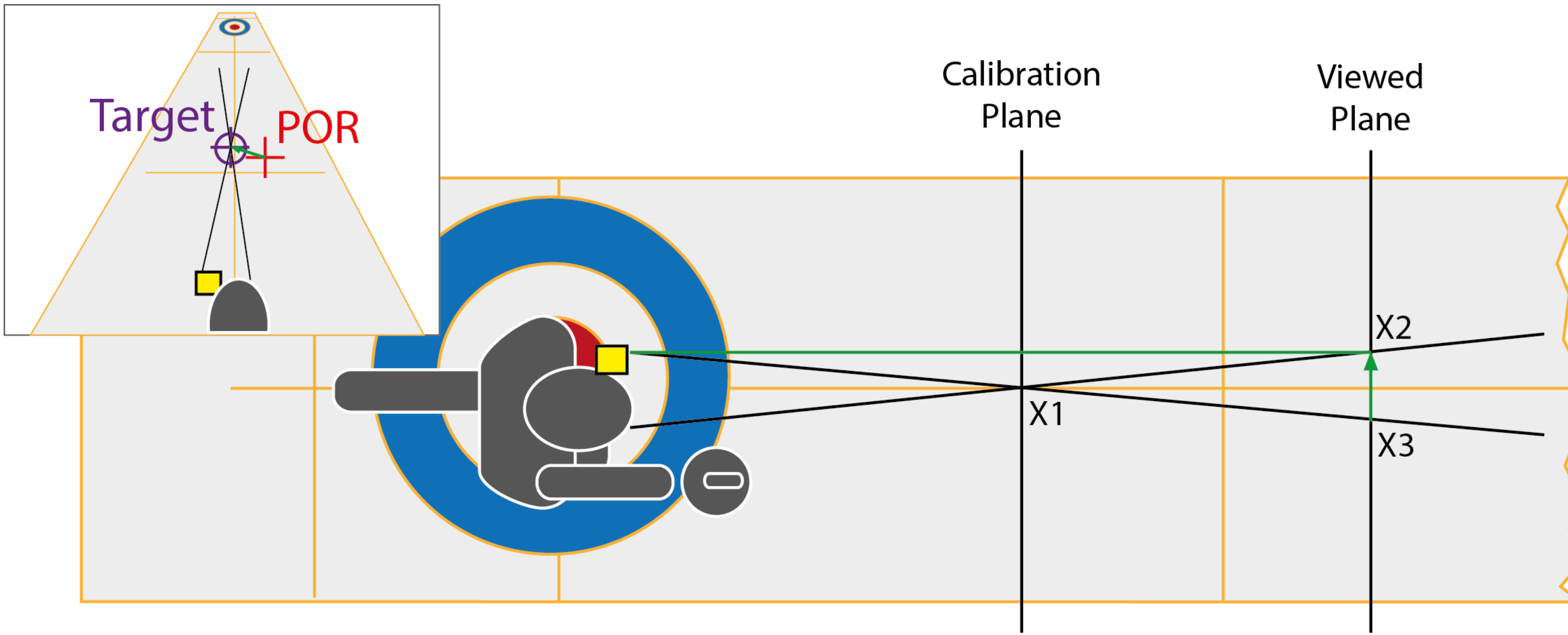


Hansen and Ji (2010)



PARALLAX ERROR

Example of parallax error during a curling daily training session

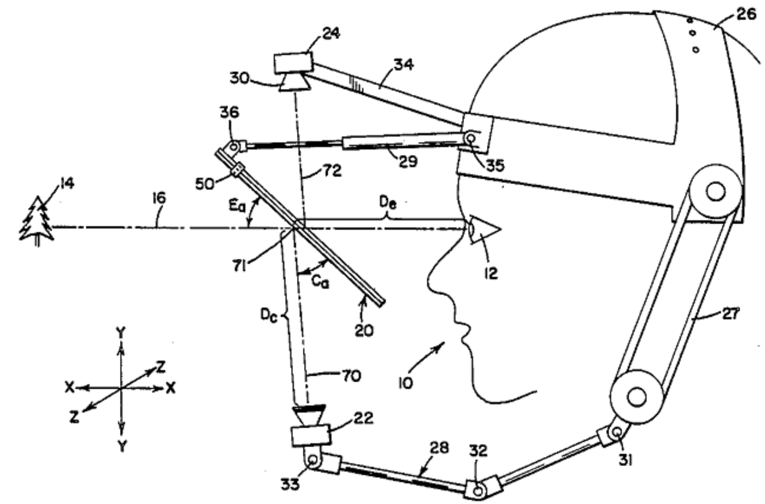


DEPTH COMPENSATION MODEL

Valez and Borah (1989) proposed a **physical setup** to remove the effects of parallax error

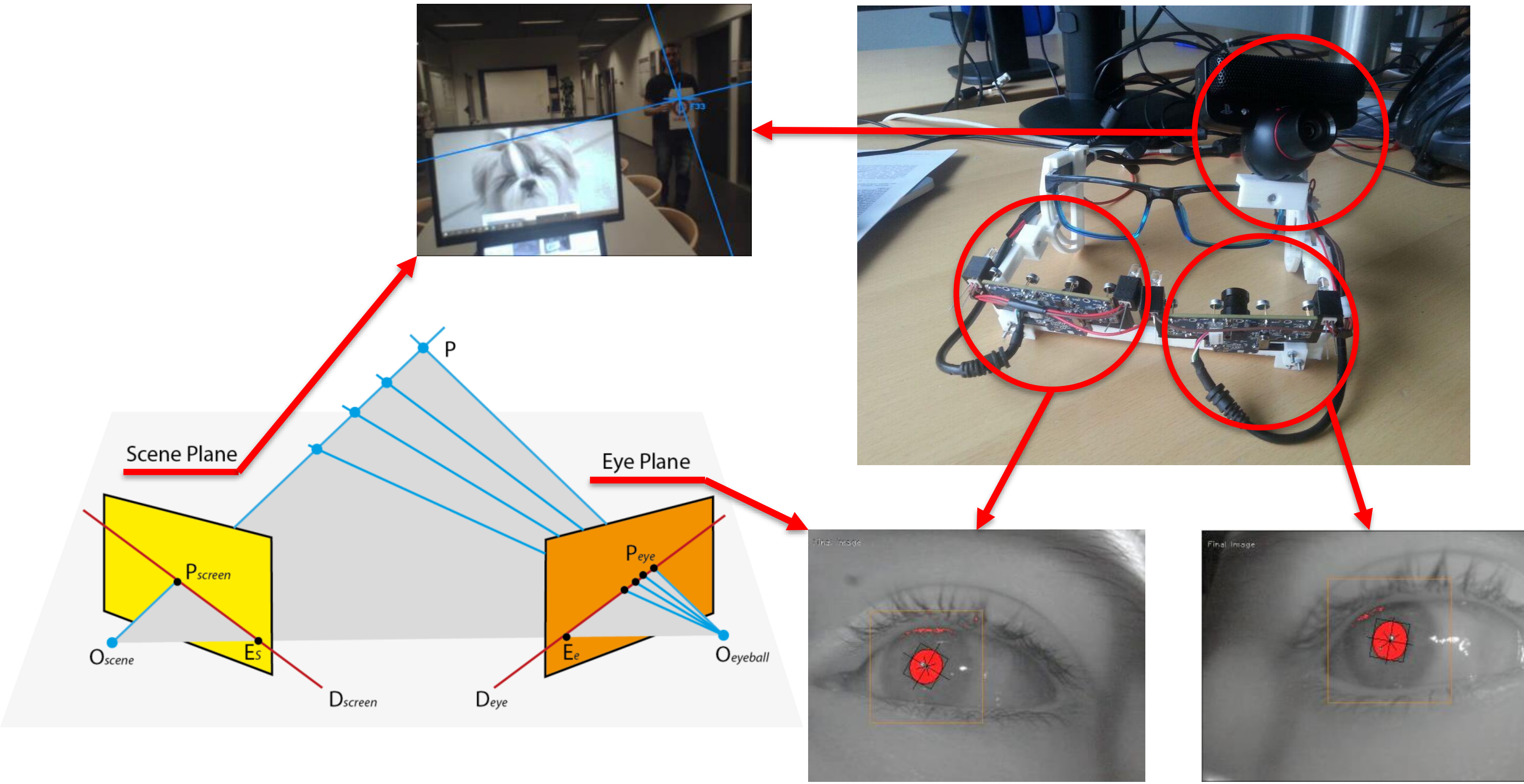
The proposed depth compensation model is based on **pure translation** motion

$$x' = x + Kt/Z$$



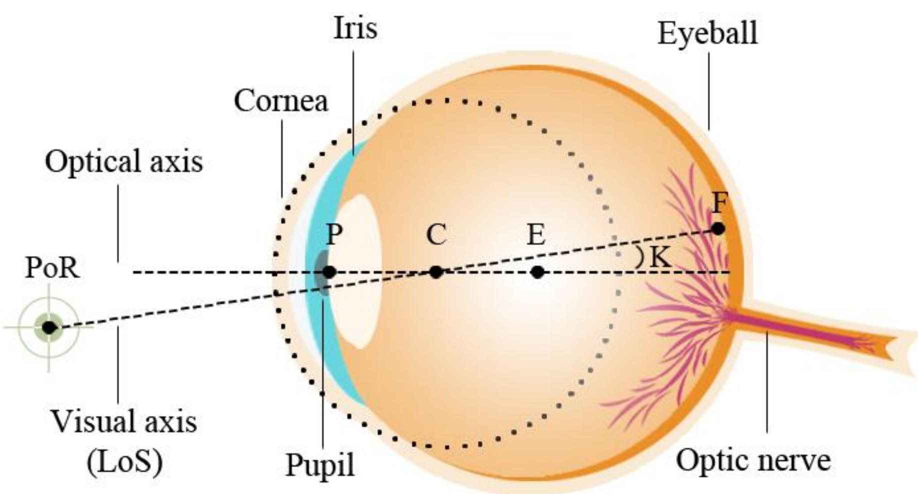
Valez and Borah (1989)

GAZE ESTIMATION METHOD



ASSESSMENT

Gaze estimation aspects evaluated during the assessment:

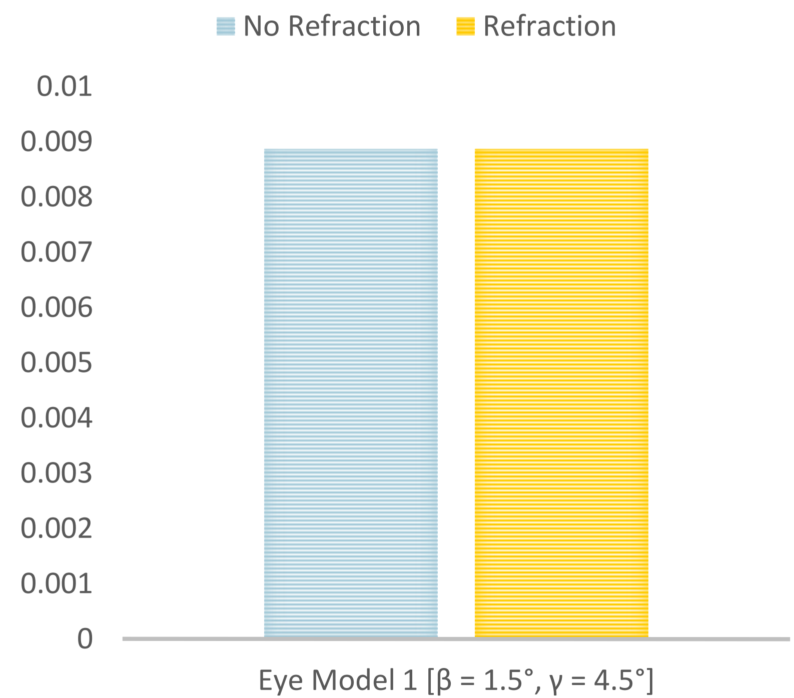


Narcizo et al. (2013)

1. Refractive index of aqueous humor [α]
2. Number of calibration points [N]
3. Horizontal [γ] and vertical [β] angle kappa offset
4. The influence of noise in the eye features detector [$P_c + \lambda$]
5. Depth movements along to the calibration plane [z-*axis*]

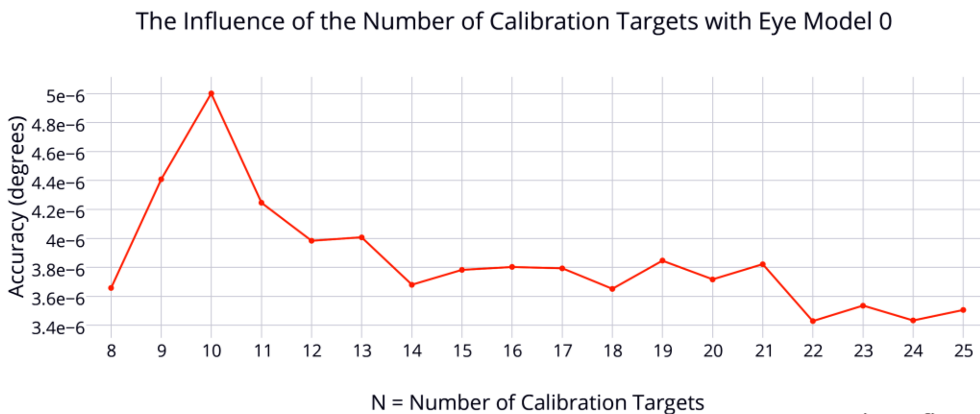
INFLUENCE OF REFRACTION

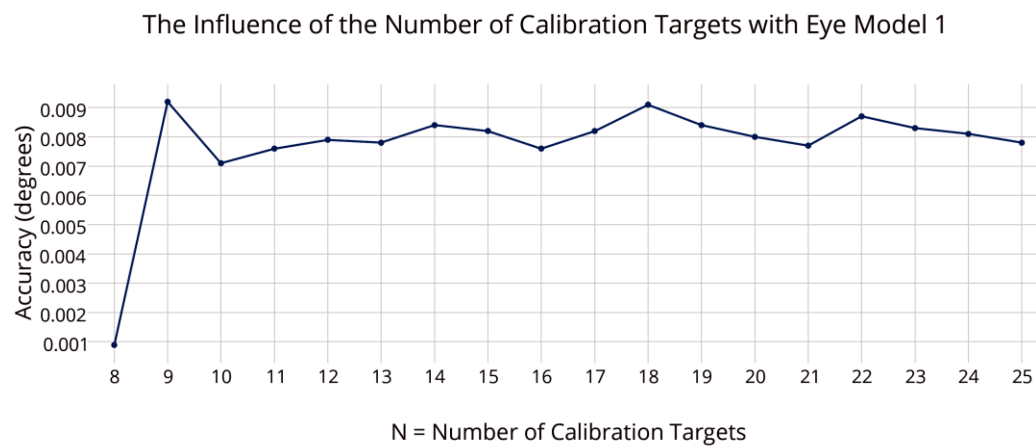
Refractive index of aqueous humor [$\alpha = 1.366$]



NUMBER OF CALIBRATION POINTS

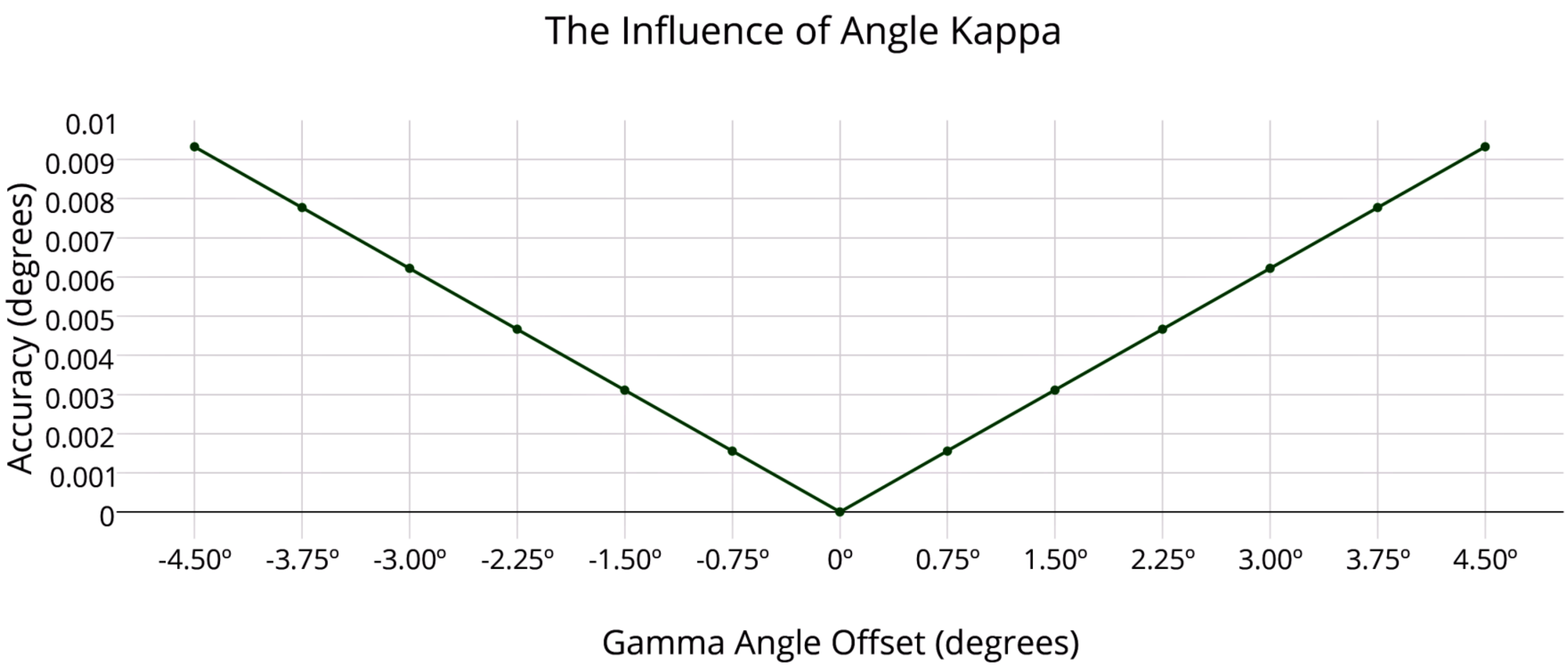
Number of calibration points





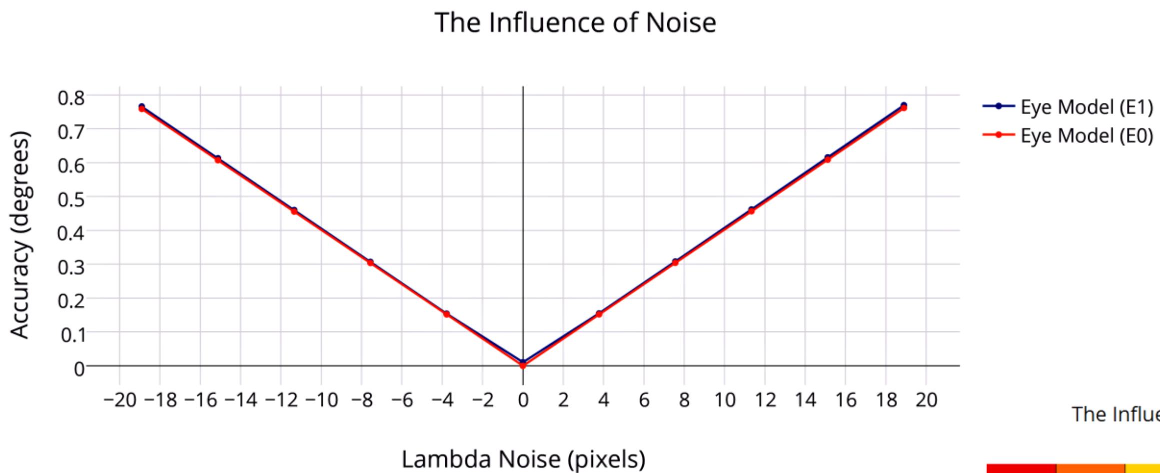
ANGLE KAPPA OFFSET

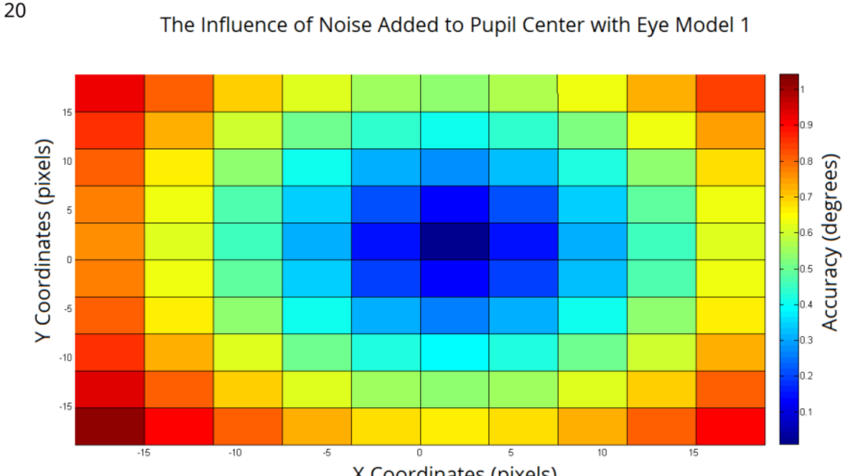
Horizontal $[-4.5° \leq \gamma \leq 4.5°]$ and Vertical $[\beta = 0°]$ angles



NOISE IN THE PUPIL ESTIMATION

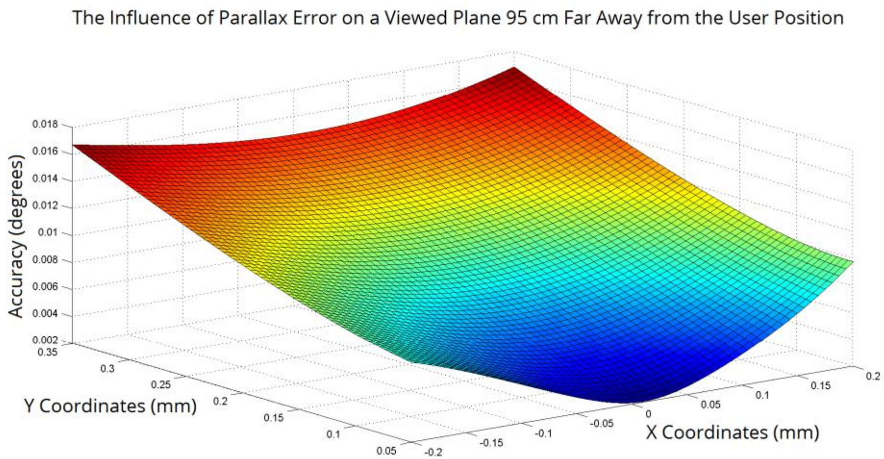
Noise (λ) added to the pupil center (P_c) coordinate [$P_c + \lambda$]

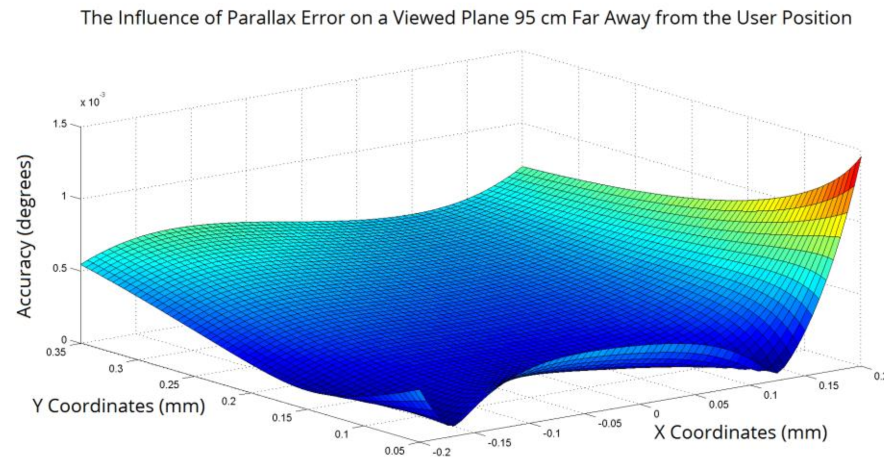


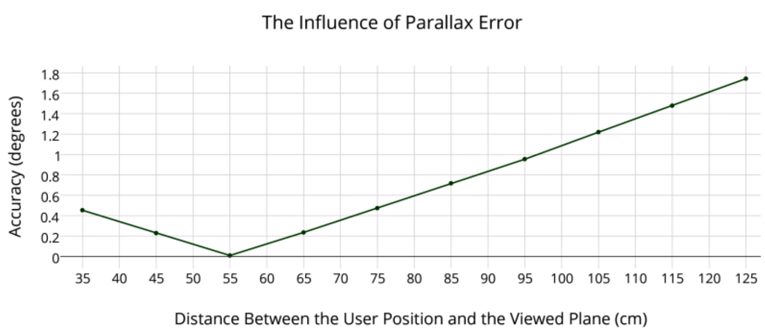


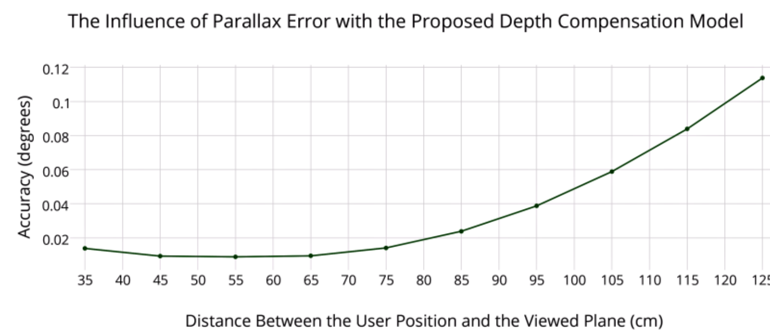
CHANGES IN DEPTH

Depth movements along to the calibration plane [z-axis = 95cm]



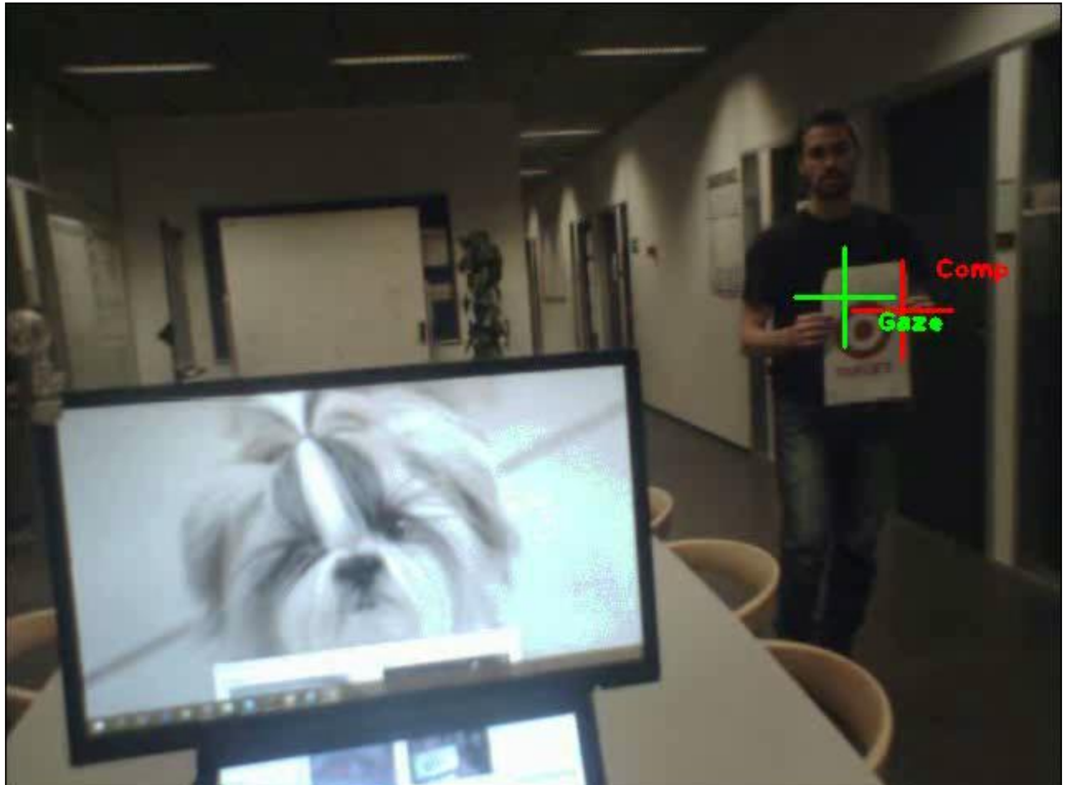






CHANGES IN DEPTH

Real eye tracking data



CONCLUSIONS

Main contributions of this paper

1. The **gaze estimation method** based on epipolar geometry has presented *high accuracy* gaze estimation
   - ✓ However, this method is *sensitive to noise*
   - ✓ Present problems with head rotations
2. The **depth compensation model** is robust when the *distance* between the user and the target is a *priori known*
   - ✓ For each 10 cm, the parallax error adds a gaze error around $\pm 0.23°$
   - ✓ The proposed model adjusts the parallax error for $\pm 0.02°$ (*10 times better*)

ACKNOWLEDGMENTS

CNPq

CIÊNCIA
SEM FRONTEIRAS

ANY QUESTIONS?

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