A cognitive robot with Vision, Sound and Language

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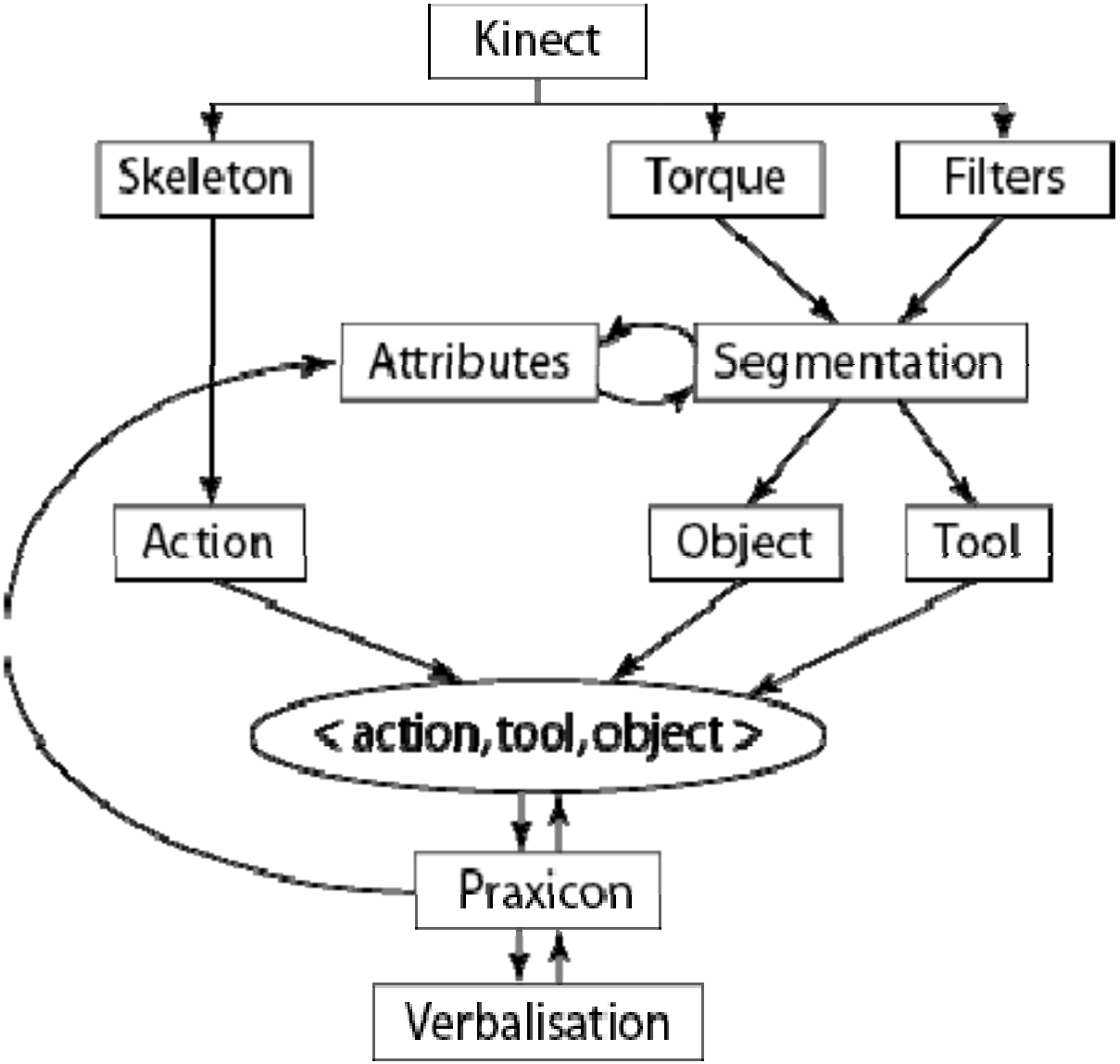
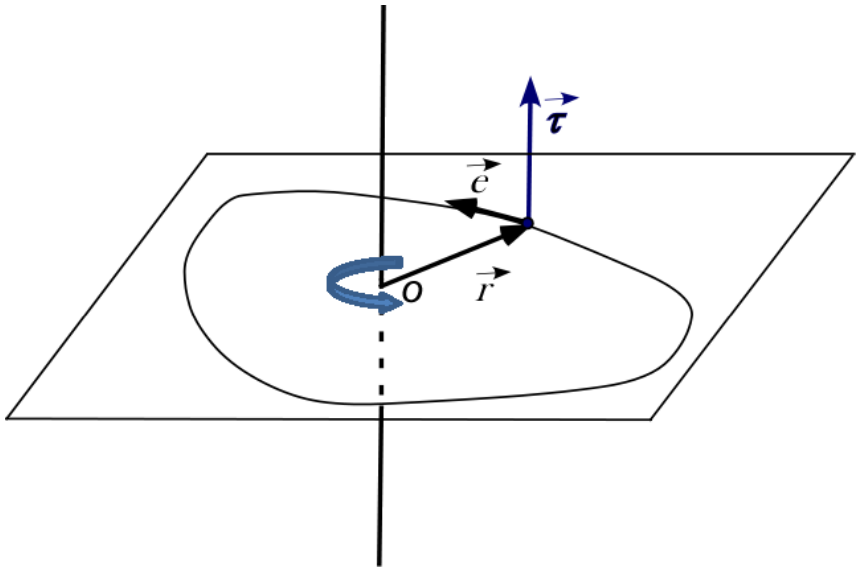
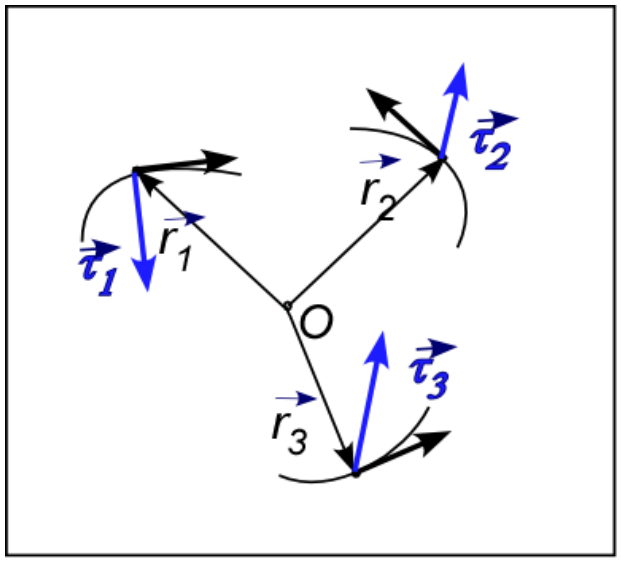
The architecture of the system



The torque

- encodes enclosed, connected regions





Torque at point r

$$torque(\vec{r}) = \vec{r} \times \vec{e}$$

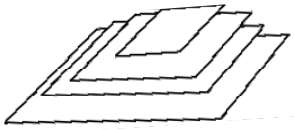
Value of torque

$$\tau(\vec{r}) = |\vec{r}| \cdot |\vec{e}| \, sin(angle(\vec{r}, \vec{e}))$$

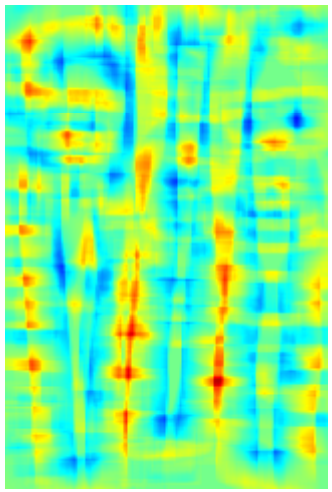
Torque in a patch

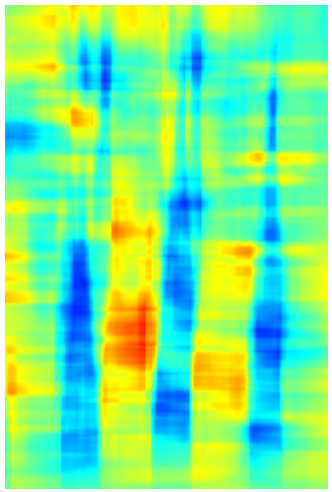
$$\tau(P) = \sum_i \tau(\vec{r}_i)$$

Torque map



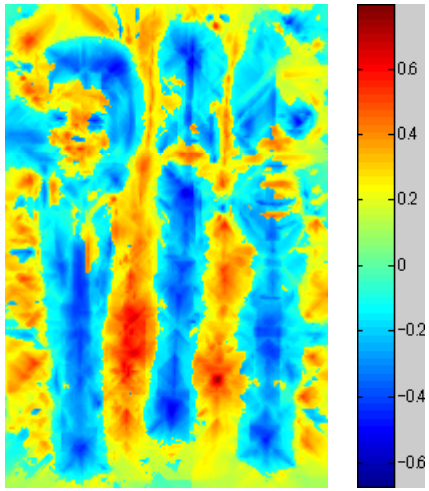
Torque at multiple Window sizes





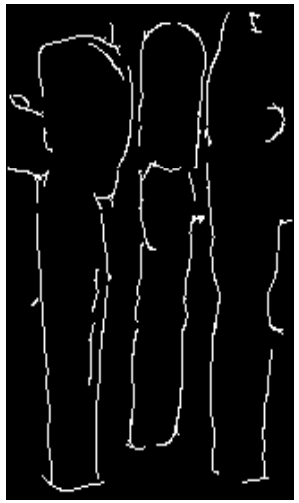
size = 5 x 5 21 x 21 45 x 45

Combined Torque map



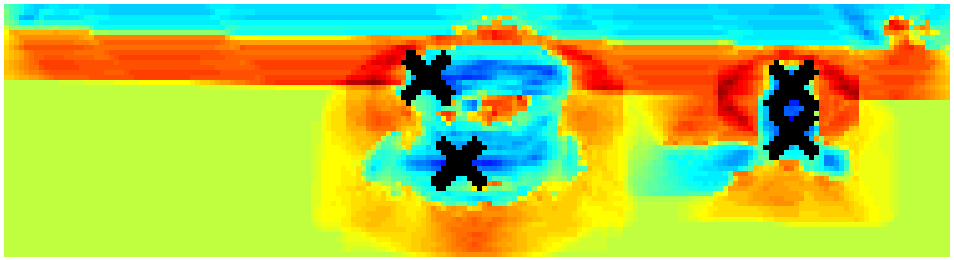
Extrema over scale

Canny edges

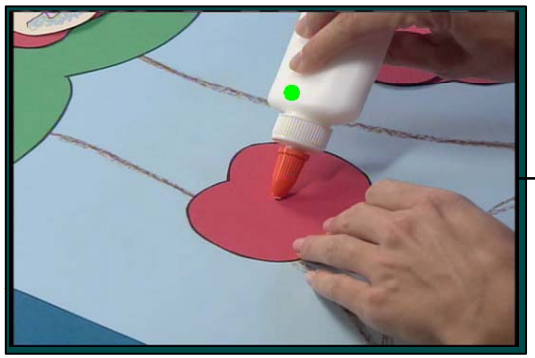


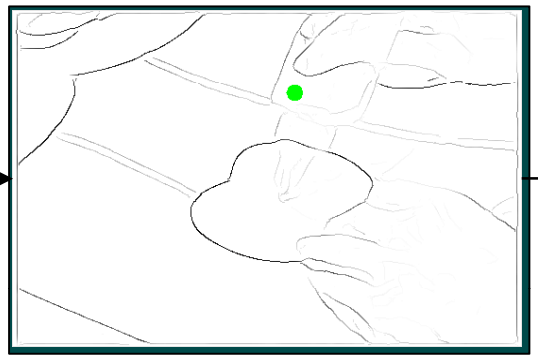
Use torque map to strengthen edges

Torque map and fixation

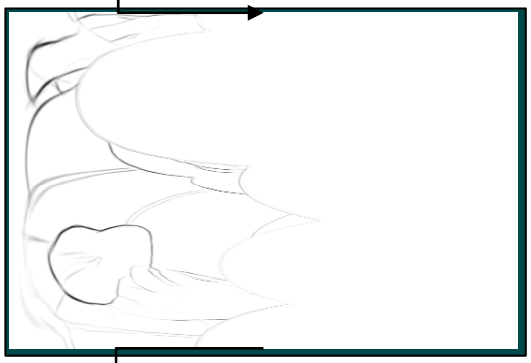


Fixation-based Algorithm

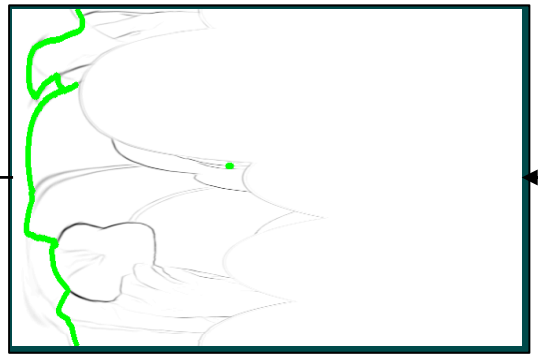


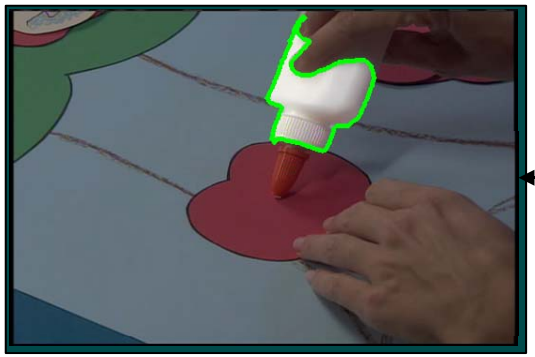


Cartesian (x,y) to Polar (r,θ)



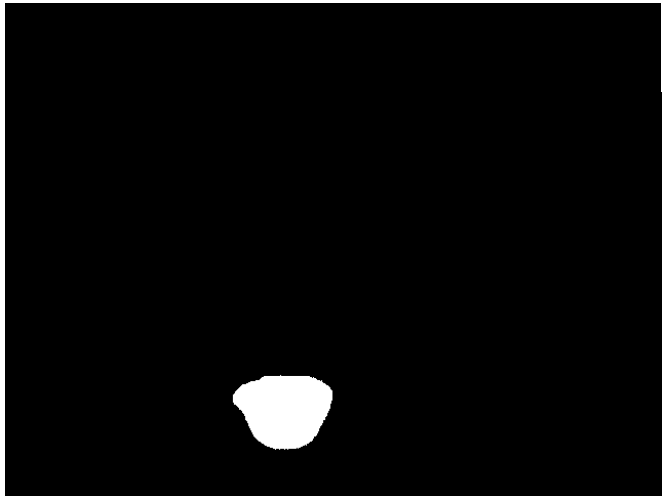
The optimal Cut *separating inside from outside*

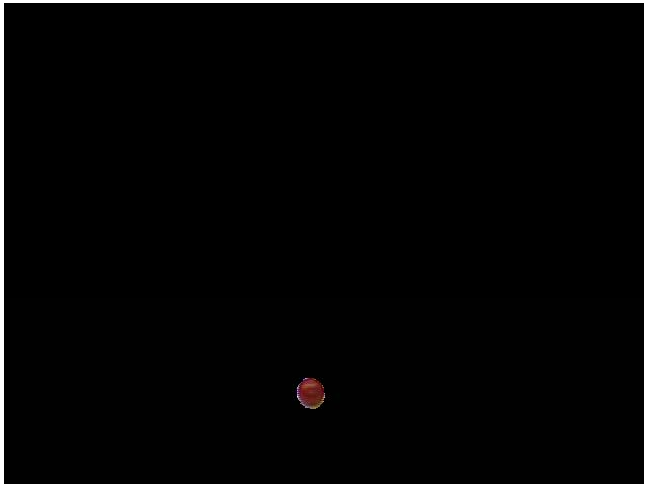




(Mishra et al, ICCV'09)

Segmentation results



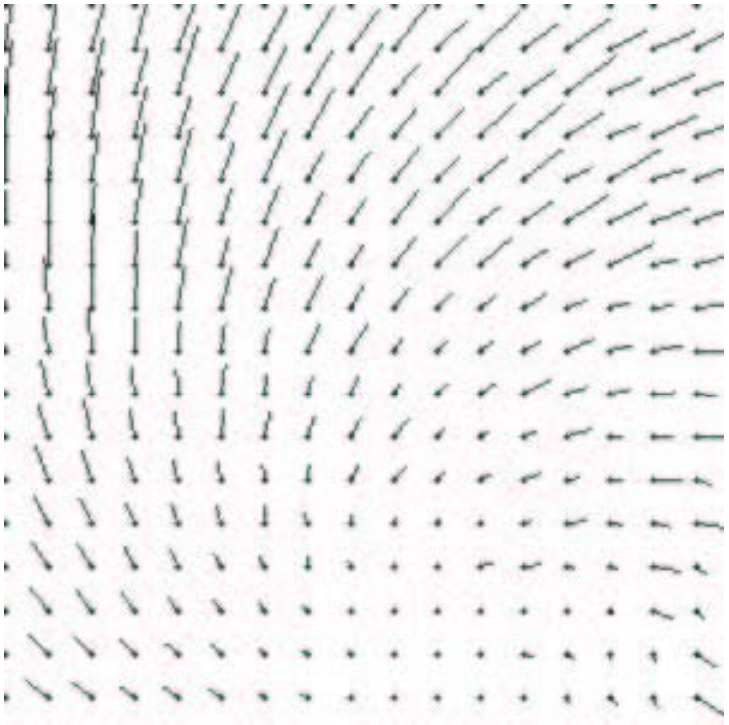


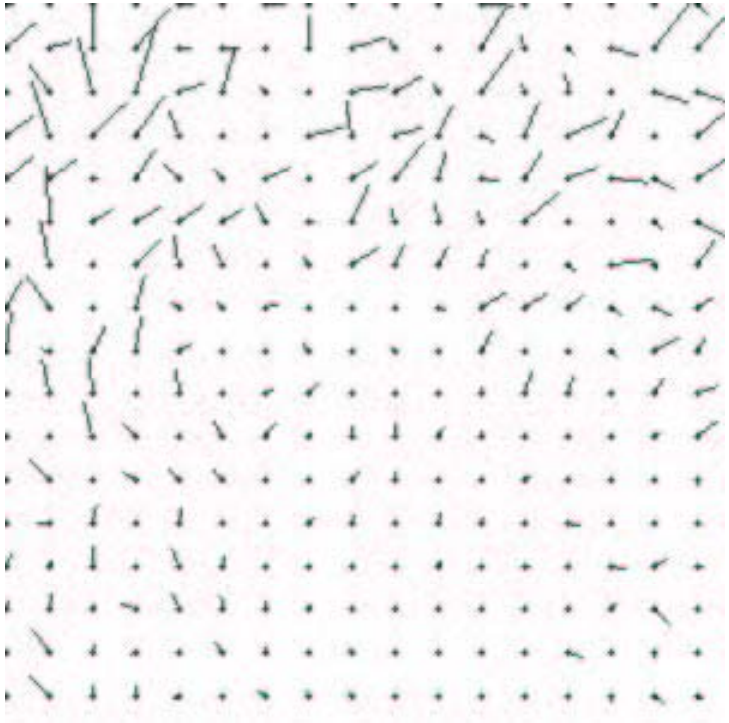
Ego-motion estimation with the DVS

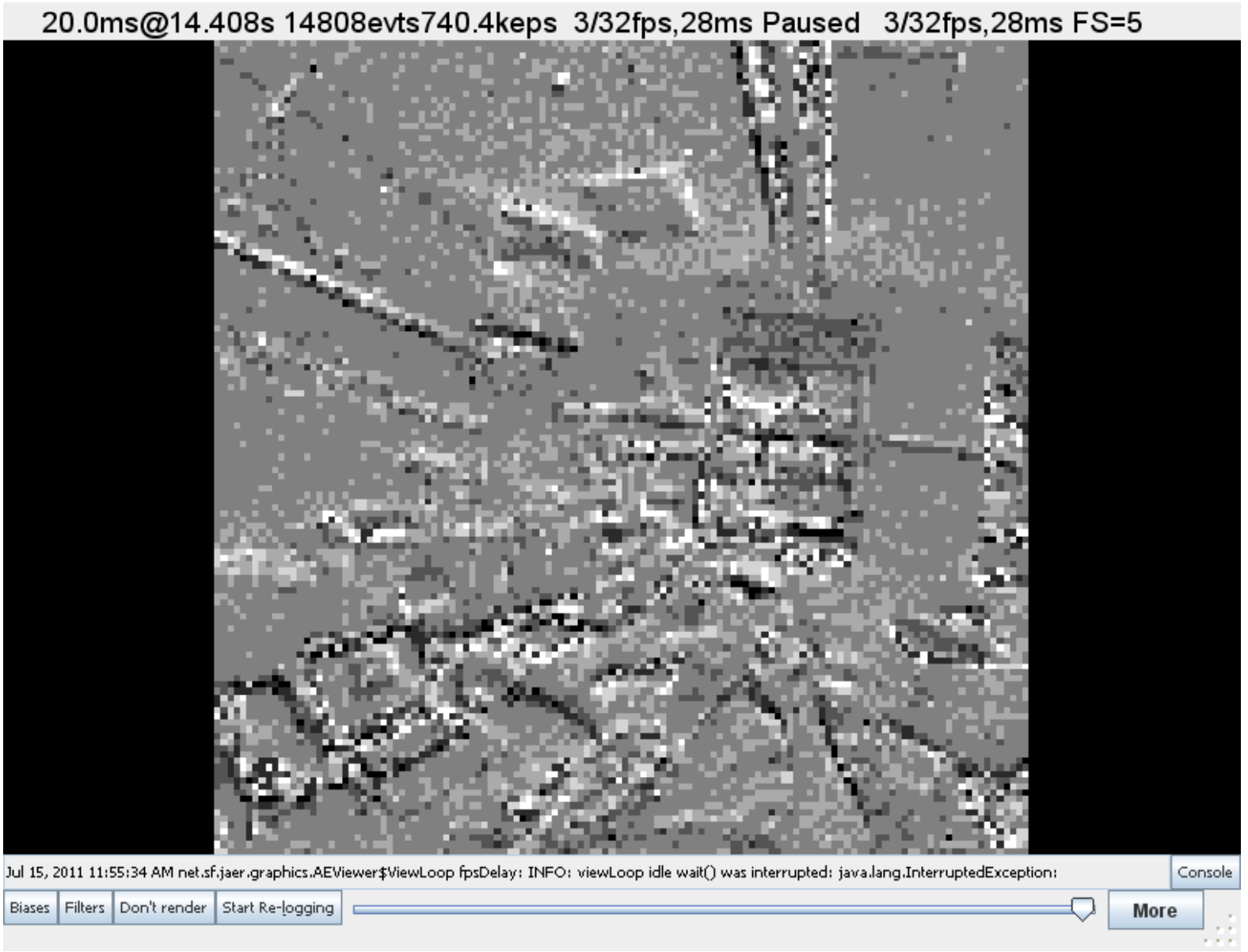
Hui Ji, Francisco Barranco, Ryad Benosman

Tobi Telbruck, Cornelia Fermüller

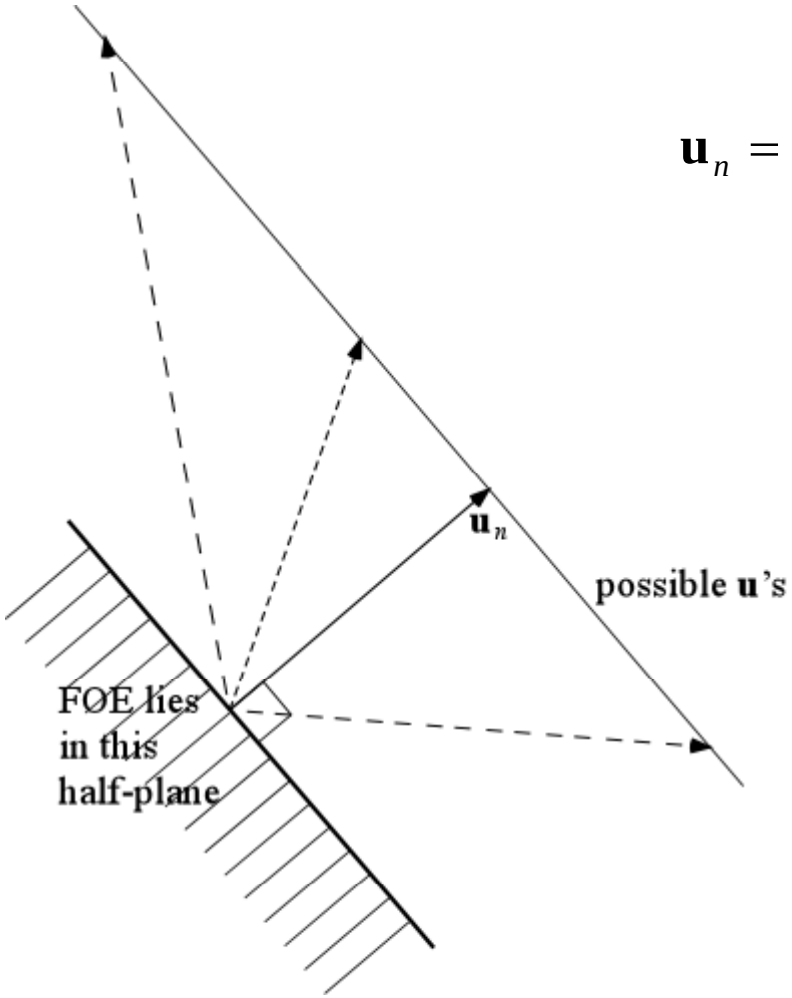
Optical flow and normal flow






20.0ms@14.408s 14808evts740.4keps 3/32fps,28ms Paused 3/32fps,28ms FS=5
Jul 15, 2011 11:55:34 AM net.sf.jaer.graphics.AEViewer$ViewLoop fpsDelay: INFO: viewLoop idle wait() was interrupted: java.lang.InterruptedException:
Console
Biases
Filters
Don't render
Start Re-logging
More

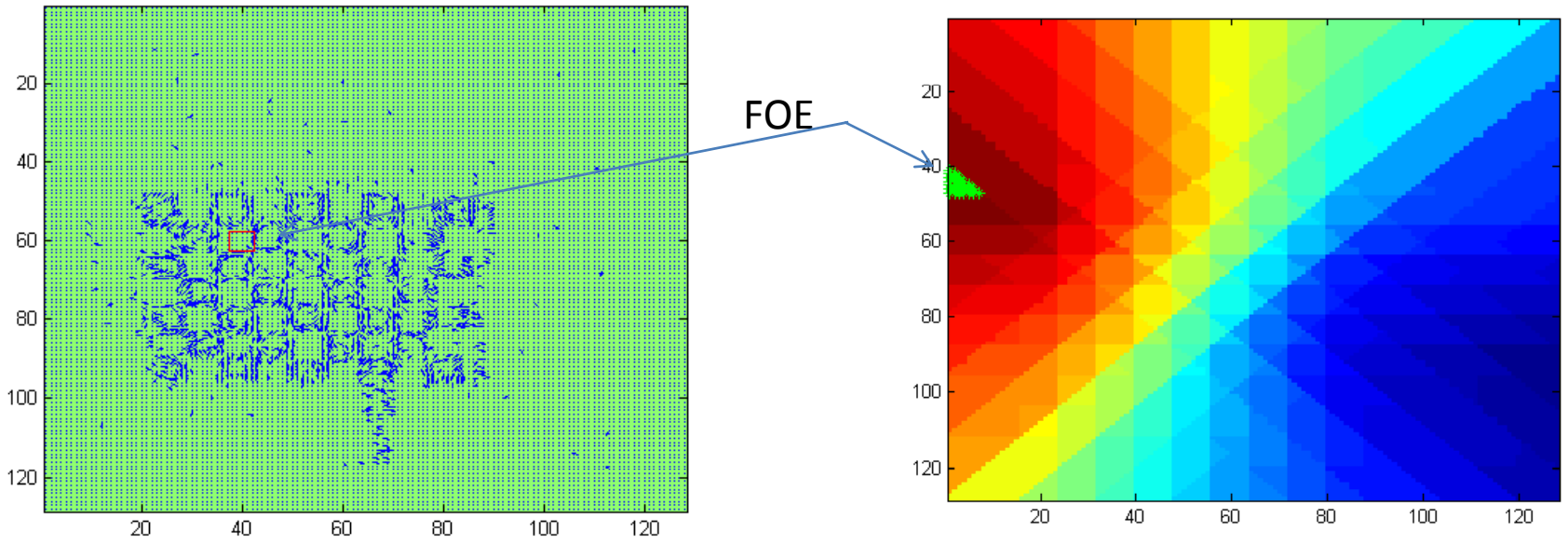
Translational Normal Flow



$$\mathbf{u}_n = \frac{\mathbf{u}_{\text{tr}}}{Z} \cdot \mathbf{n}$$

- In the case of translation each normal flow vector constrains the location of the FOE to a half-plane.
- Intersection of half-planes provides FOE.

Results



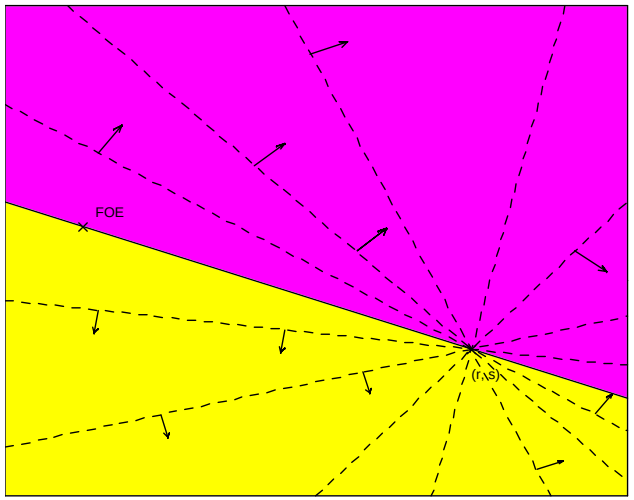
Flow field

Map for voting on the FOE

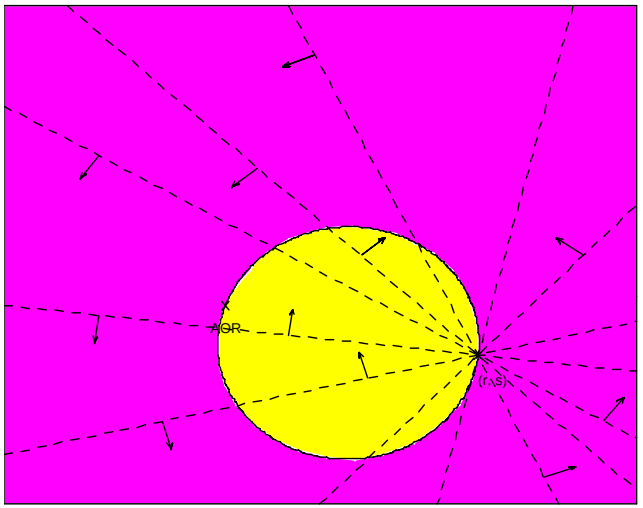
Translation and Rotation

Idea: choose copoint and coaxis vectors

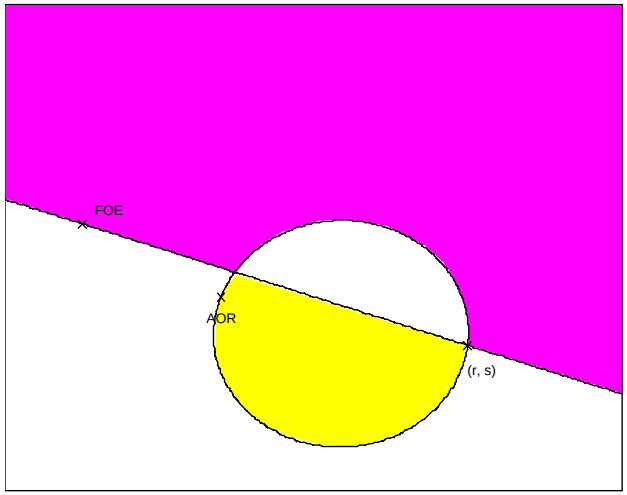
translational component



rotational component



the general case



Results of fitting lines to positive and negative values to locate FOE