

Tracking of Dynamic Objects Based on Optical Flow

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Overview

Problem

Optical Flow

Tracking

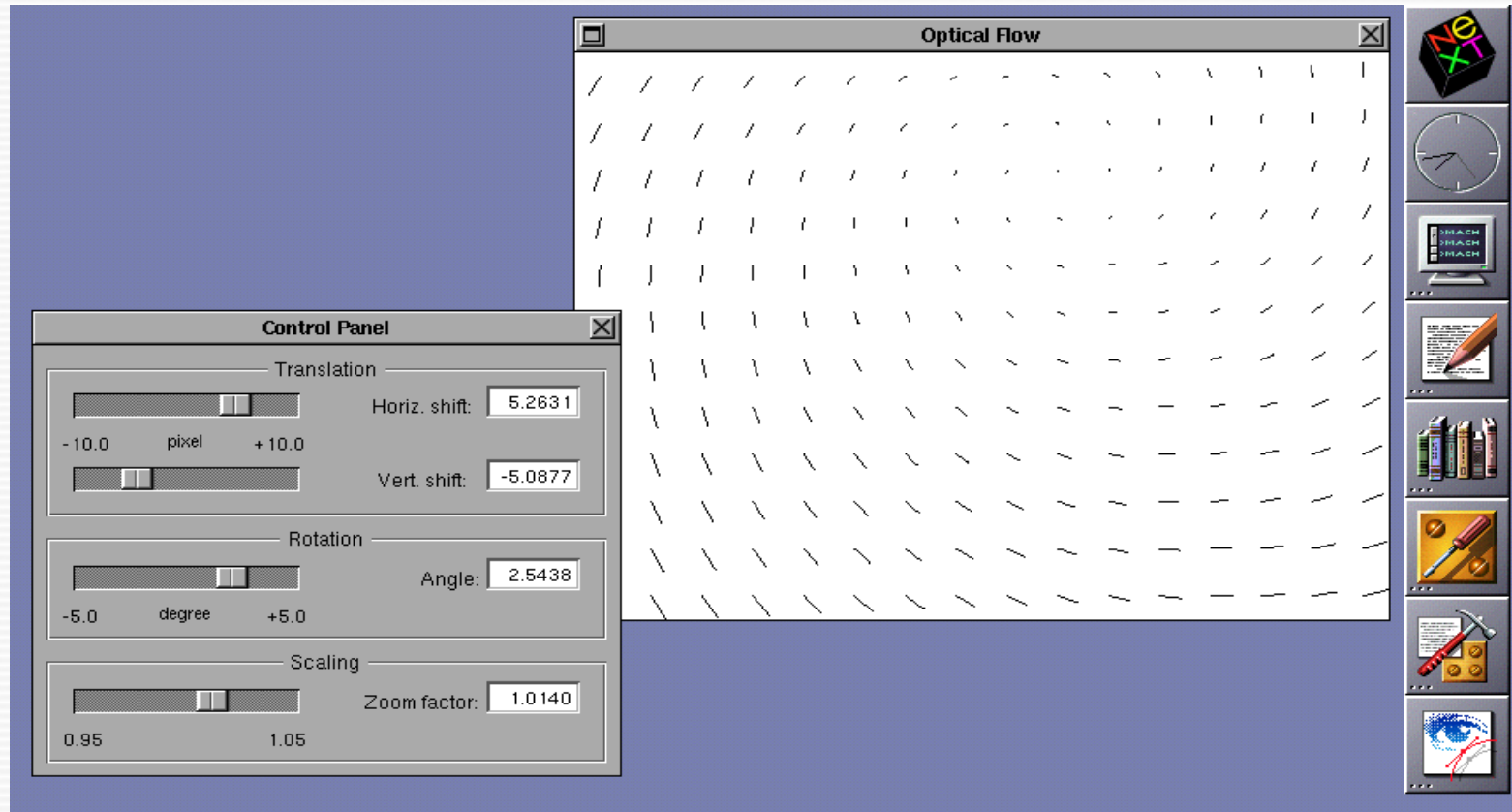
Hierarchical Algorithm

Future Work

Problem

- design and implement an integrated navigation and tracking module
- identify dynamic objects with the help of optical flow for tracking
- recover the camera motion (or at least the heading direction) for navigation

Optical Flow



Tracking

- identification of dynamic objects with optical flow
 - non-moving camera (passive tracking)
 - moving camera (active tracking)
- active tracking requires a compensation of the optical flow generated by egomotion

Global Flow Field Parameters

translation in horizontal direction

$$t_x$$

translation in vertical direction

$$t_y$$

zoom factor

$$z = \frac{\sum xm_x + \sum ym_y}{\sum (x^2 + y^2)}$$

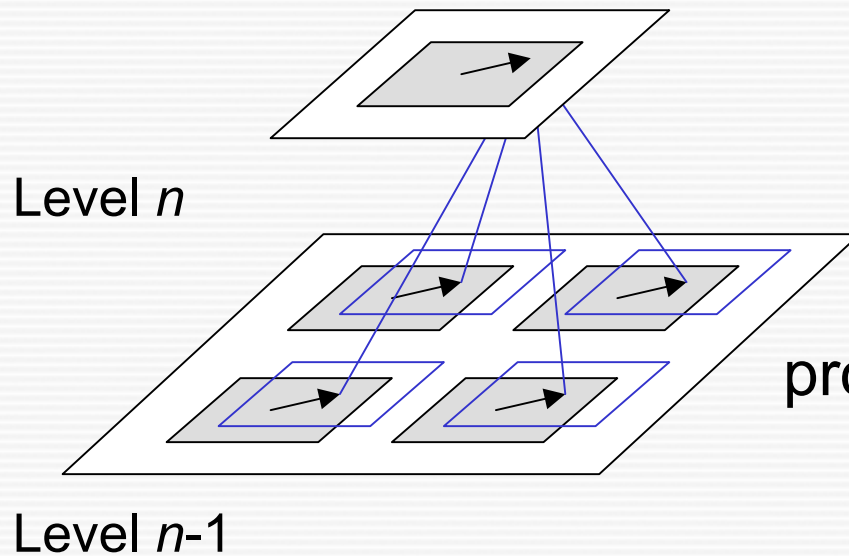
rotation angle

$$\alpha = \frac{\sum xm_y + \sum ym_x}{\sum (x^2 + y^2)}$$

Limits

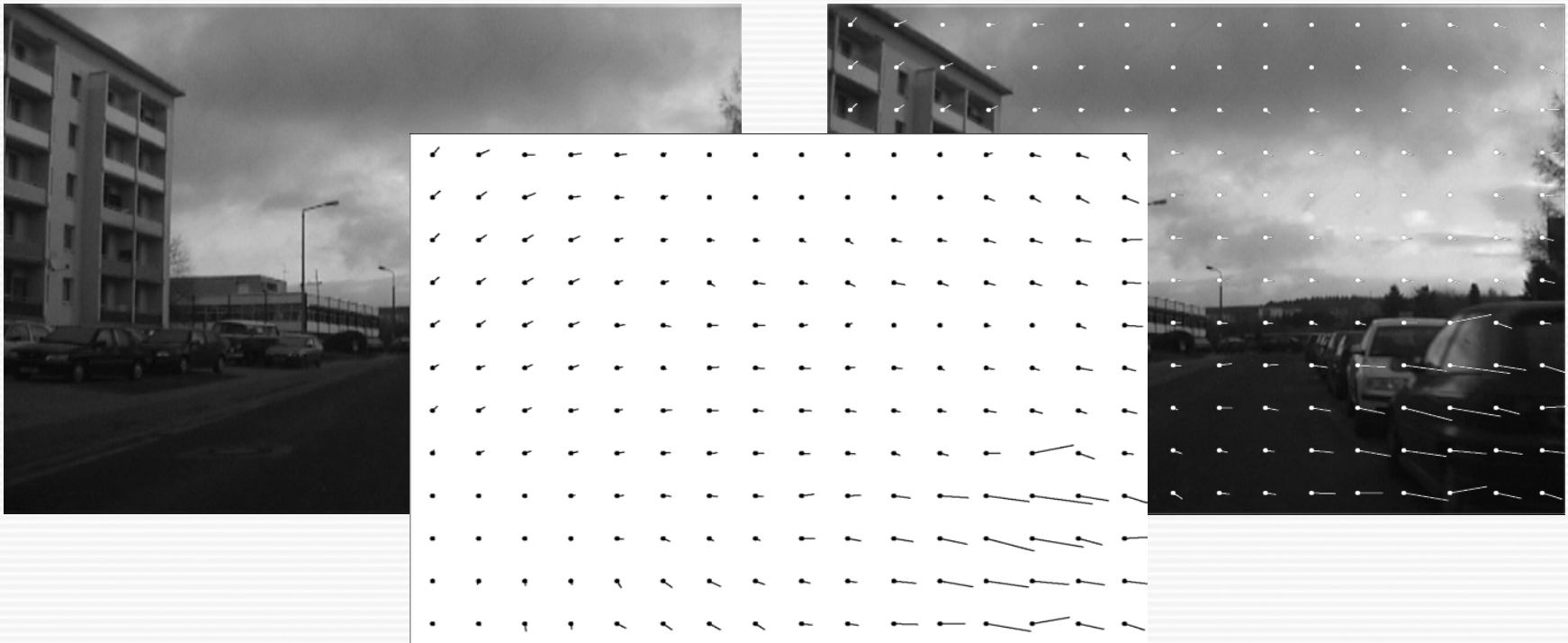
- a single flow region can detect movements up to 2 pixels/frame
- using an image hierarchy we can measure
 - translation at 48 pixels/frame
 - zoom at 5 percent/frame
 - rotation 5 degree/frame

Hierarchical Algorithm



flow vectors at
a given level are
projected to the next lower
level to reduce the
remaining flow there

Example



Future Work

- integration of other sensors (sensor fusion)
- more accurate estimation of the egomotion
- possibility to map the surrounding terrain

Are there any questions?