VO Video Analysis

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Motion detection and optical flow: Demos

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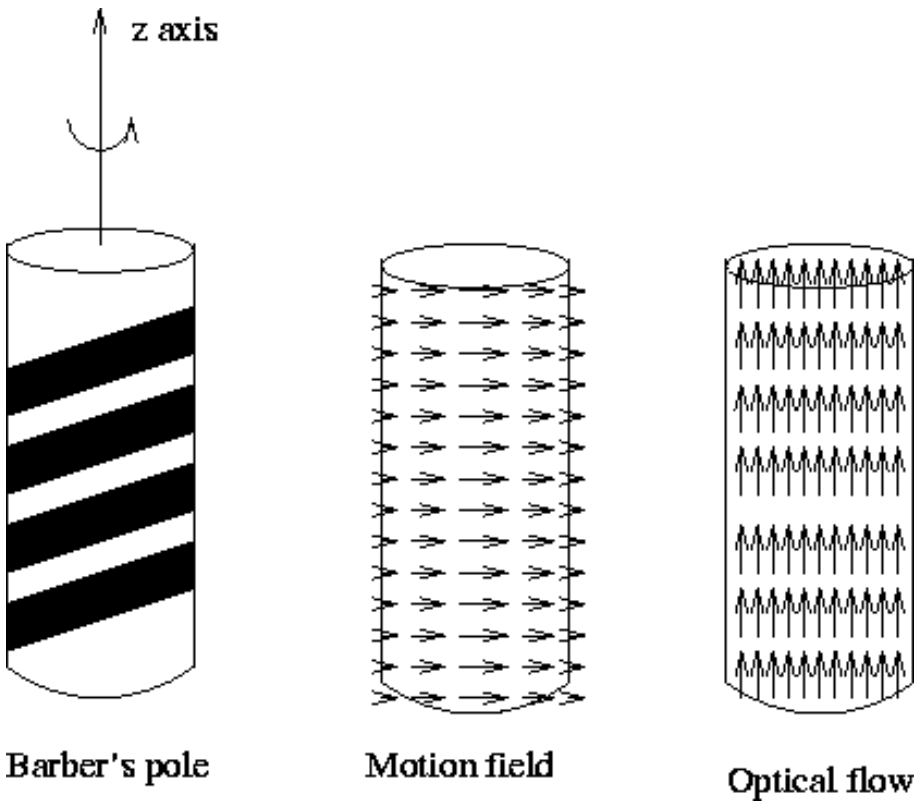
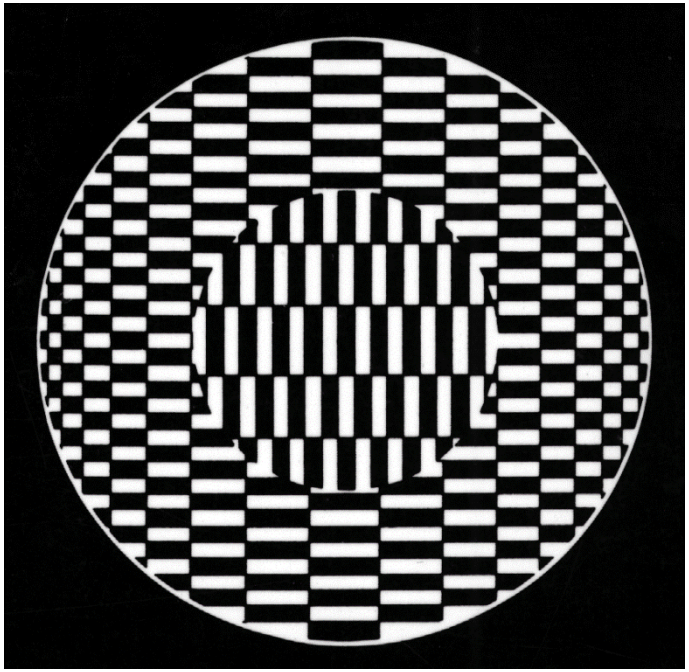
Optical flow (1) – The barber's pole illusion



The object in the leftmost illustration rotates along its *z*-axis, as indicated by the motion field in the middle illustration.

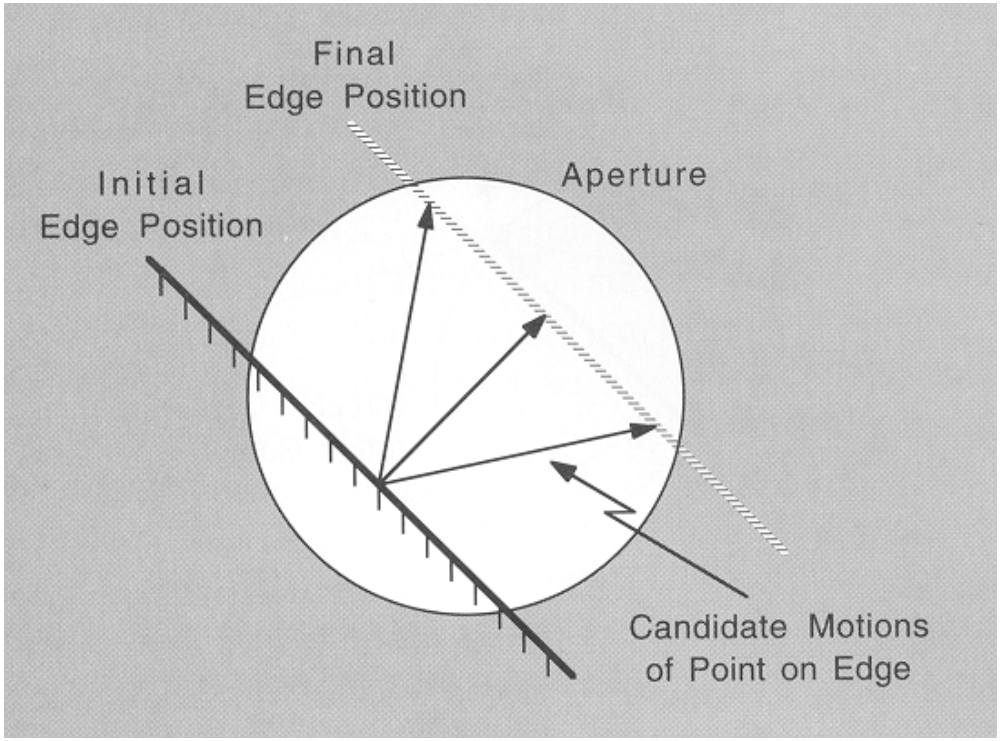
Is the optical flow field in the rightmost illustration correct?

Optical flow (2) – Optical illusion

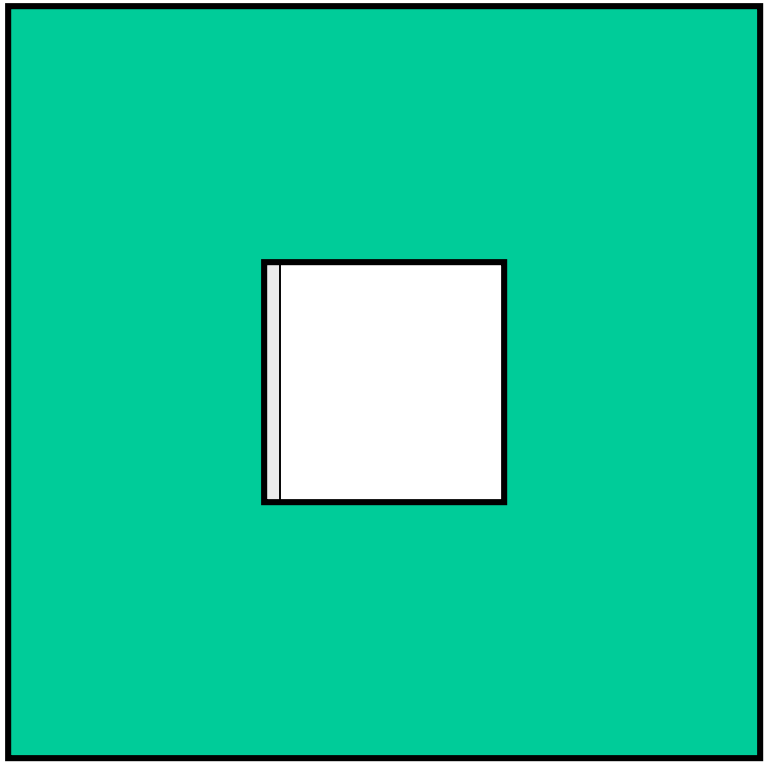


Optical flow (3) – Aperture problem

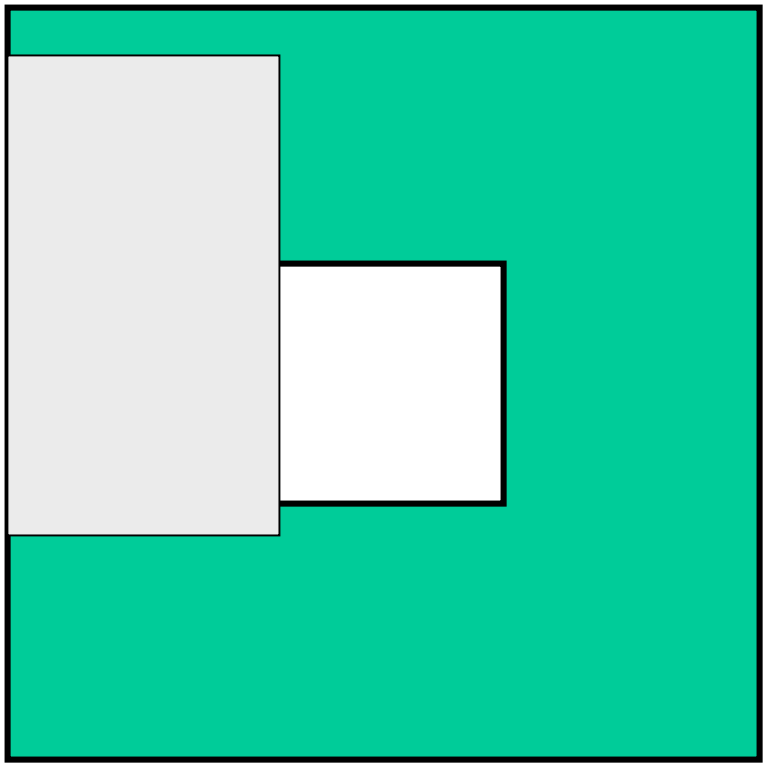
The motion vector is not uniquely determined.



Optical flow (4) – Aperture problem



Optical flow (5) – Aperture problem



Motion detection: Demo (1)

- **Demonstration of block-based approach for motion detection in image sequences**
- **Demo software: Image and Video Compression Learning Tool (TU Delft)**
- **Tests: consequences of parameter variation**
  - **Change of block size**
  - **Change of size of search window**
  - **Exhaustive search vs. hierarchical search**
  - **Observation of temporal behavior**

Motion detection: Demo (2)

Original sequence

Computed motion vectors

Difference frames of original sequence

Difference frames upon consideration of the detected motion (motion-compensated difference frames)

Fig. Screenshot of the tool, with frames/results depicted

Motion detection: Demo (3)

- **Applications of detected motion vectors**
  - **The aim in applying detected motion vectors in support of *video coding* is that the motion-compensated difference frames be coded with as few bits as possible**
  - **In this regard, even imperfect motion detection results can lead to satisfactory video coding outputs**
  - **Other applications (e.g., segmentation of video objects) may call for different (e.g., higher) quality of the detected motion vectors**

Motion detection: Demo (4) - Observations

- **Search Area**
  - **The choice of appropriate size of the search area is critical**
  - **Large search areas increase running time considerably. Owing to the larger number of possible solutions, there is a greater probability that the wrong solution will be found (e.g., due to image noise)**
  - **That a search area that is too small (i.e., the correct solution lies outside the search area and can accordingly not be found) can sometimes be detected in the form of an "irregular" pattern among the motion vectors**

Motion detection: Demo (5) - Observations

- **Rotation**
  - **A block-based (translational) motion model will not capture the rotation of image objects (e.g., the motion of wheels on an automobile)**
- **Running time**
  - **The high running time of an exhaustive search vis-à-vis a hierarchical one (and other “non-exhaustive” search algorithms) can be clearly recognized in the demo**