



Lecture 16: Tracking

Feature tracking

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CS131 Computer Vision: Foundations and Applications





What will we learn today?

- Feature Tracking
 - Problem statement
 - Overview

Reading: [Szeliski] Chapters: 8.4, 8.5

[Fleet & Weiss, 2005]

<http://www.cs.toronto.edu/pub/jepson/teaching/vision/2503/opticalFlow.pdf>

Problem statement

Image sequence



Slide credit: Yonsei Univ.



Problem statement

Feature point detection

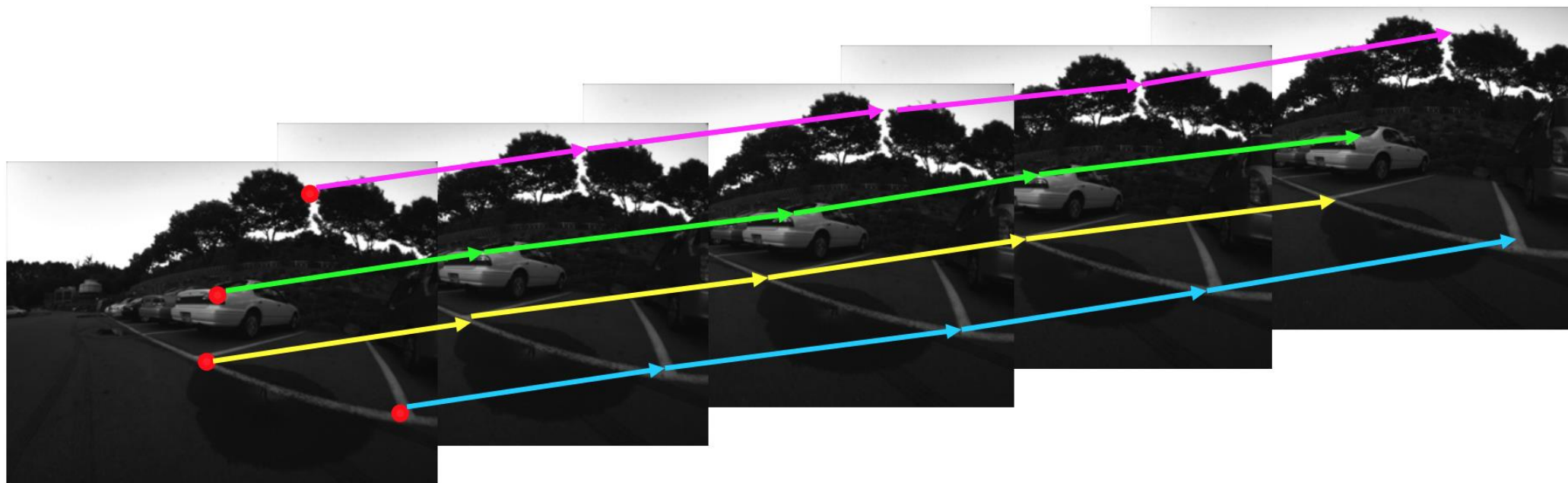


Slide credit: Yonsei Univ.



Problem statement

Feature point tracking



Slide credit: Yonsei Univ.



Single object tracking



Multiple object tracking



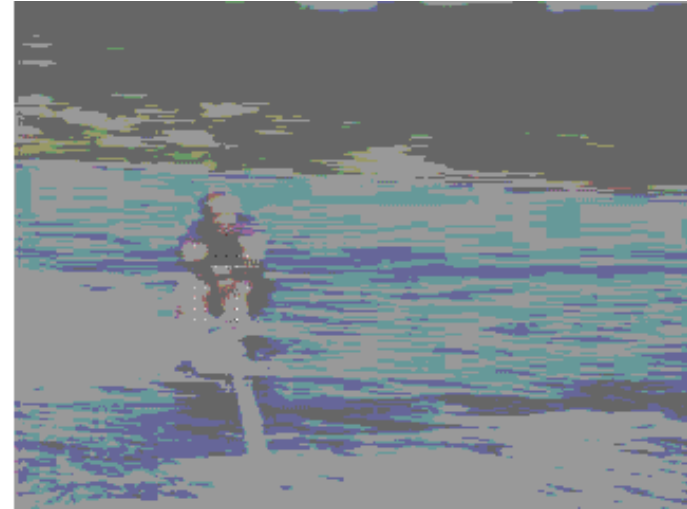
Tracking

Feature tracking

Tracking with a fixed camera



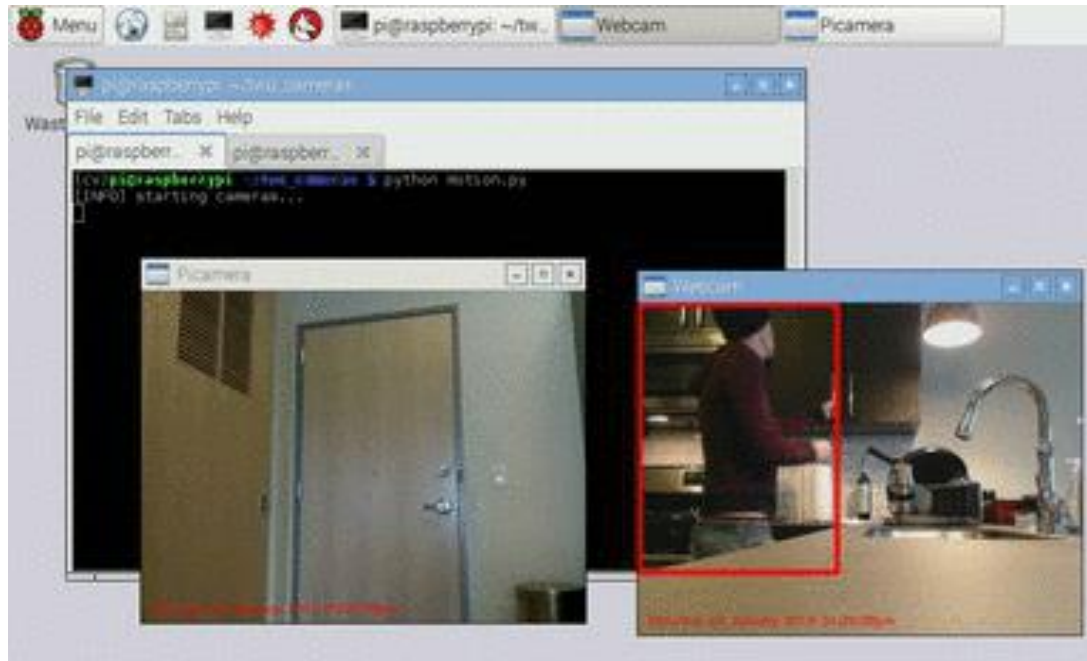
Tracking with a moving camera



Tracking

Feature tracking

Tracking with multiple cameras





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Challenges in Feature tracking

- Figure out which features can be tracked
 - Efficiently track across frames
- Some points may change appearance over time
 - e.g., due to rotation, moving into shadows, etc.
- Drift: small errors can accumulate as appearance model is updated
- Points may appear or disappear.
 - need to be able to add/delete tracked points.



What are good features to track?

- Intuitively, we want to avoid smooth regions and edges. But is there a more principled way to define good features?
- **What kinds of image regions can we detect easily and consistently?** Think about what you learnt earlier in the class.



What are good features to track?

- Can measure “quality” of features from just a single image.
- Hence: tracking Harris corners (or equivalent) guarantees small error sensitivity!

Source: Silvio Savarese



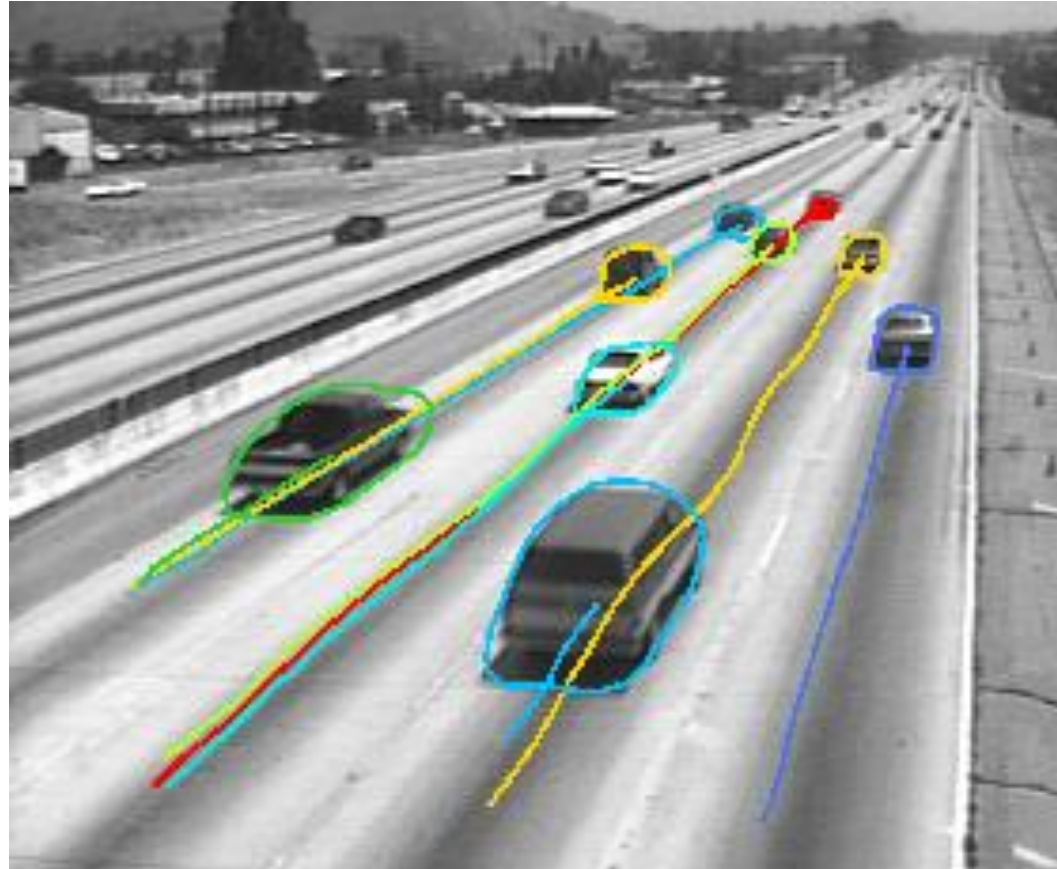
Motion estimation techniques

- Optical flow
 - Recover image motion at each pixel from spatio-temporal image brightness variations (optical flow)
- Feature-tracking
 - Extract visual features (corners, textured areas) and “track” them over multiple frames

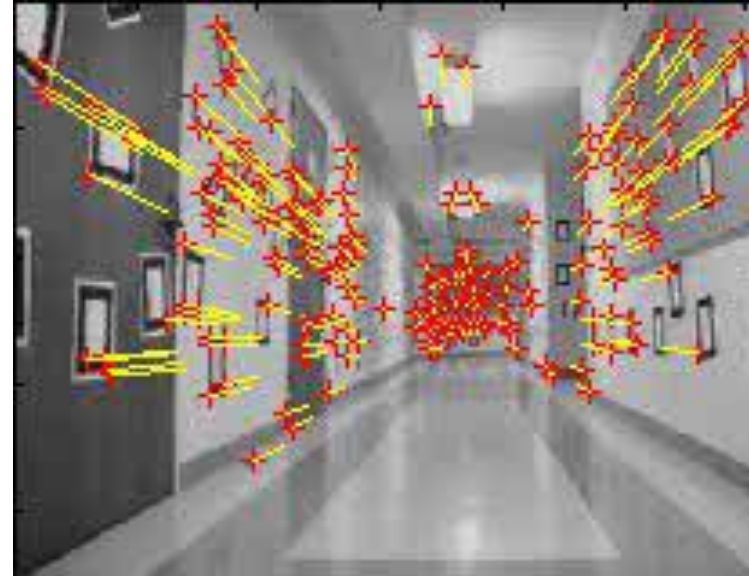


Optical flow can help track features

Once we have the features we want to track, Lucas-Kanade or other optical flow algorithms can help track those features



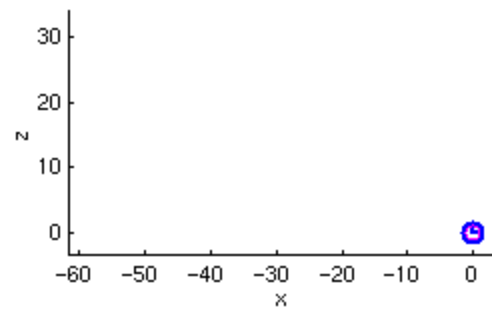
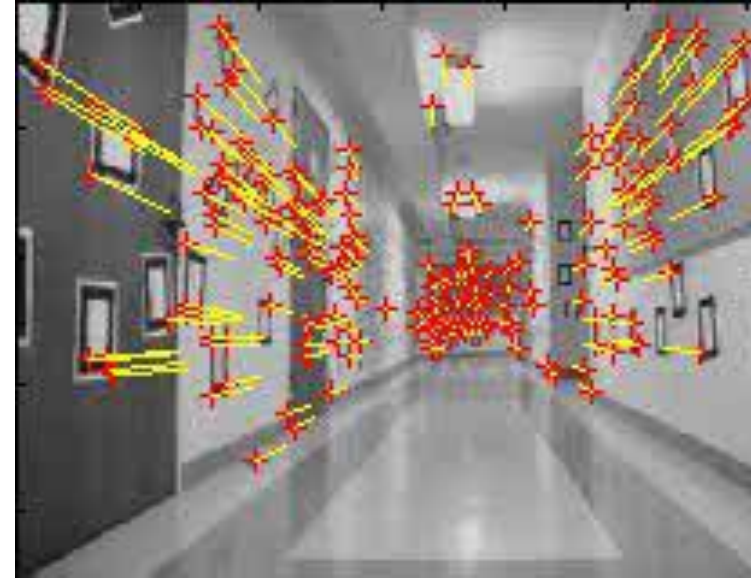
Feature-tracking



Courtesy of Jean-Yves Bouguet – Vision Lab, California Institute of Technology



Feature-tracking



Courtesy of Jean-Yves Bouguet – Vision Lab, California Institute of Technology



Summary

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 - Overview

