Practical Course:
Vision-based Navigation
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Projects

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1. MAV Navigation to Photo-Goal

- Idea:
  Direct where your ordered packet should be delivered to by taking a photo of the goal location..

- Possible approach:
  - Direct image alignment for tracking
  - Simplifications to start with:
    - Take a RGB-D photo
    - Start from a nearby view
  - Make gradually more difficult
    - Small or no overlap with the goal view
   - LSD-SLAM instead of RGB-D

2. MAV Formation Flight

- Follow a leading MAV at a fixed relative pose

- Possible approach:
  - All computations on a base station PC
  - Wireless communication
  - EKF filtering of relative leader MAV pose from
    - Controls of both MAVs
    - Direct image alignment for pose tracking
  - Approach leader at a predefined relative position/yaw orientation
  - Simplifications to start with:
    - Take a RGB-D snapshot (single image segment)
    - Start from a nearby view
  - Make gradually more difficult
    - Small or no overlap with the snapshot view
    - Take and track a multi-view model of the leader MAV

3. MAV Basketball
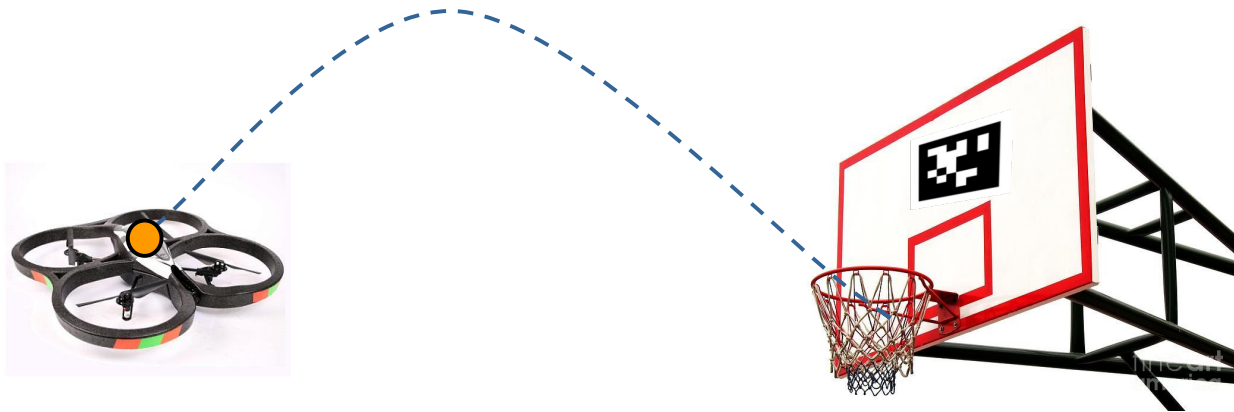
- Through a ping-pong ball mounted on top of the drone into a basket
- Possible approach:
    - Track visual markers to localize the drone.
    - Calibrate basket location relative to the marker
    - Compute trajectory to through a ball
    - Track the ball using the camera
    - Use machine learning to optimize the trajectory

3. MAV Basketball

4. Person Following

- Follow a person with onboard camera on the quadcopter
- Try different options for human detection:
    - Bright color T-shirt: BLOB detector
    - Markers
    - Keypoints on textured objects
    - ….
- Evaluate stability of tracking
- Implements several flight modes

4. Person Following

5. Drone Avoids Being Shot

- User tried to shoot the drone with a toy gun. The drone has to perform a maneuver to avoid being shot
  - Get location of the drone and gun using Motion Capture system
  - Keep the drone from the shooting line
  - Keep it in pre-defined volume of the room

Questions ?