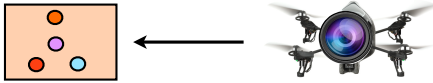
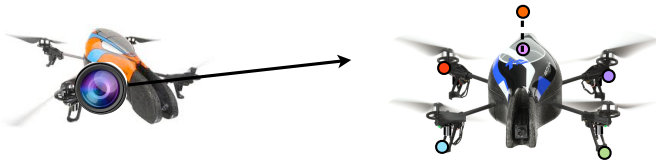
Three scenarios

Pattern on environment

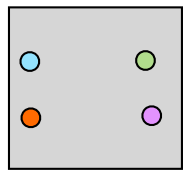


Fixed camera, pattern on Parrot

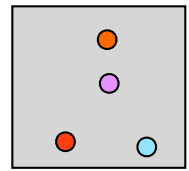
Camera on other quadrotor



bottom view

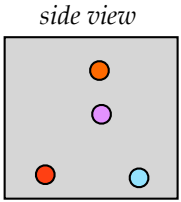


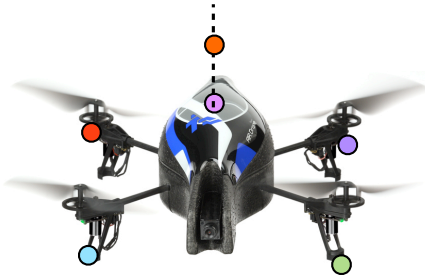
side view

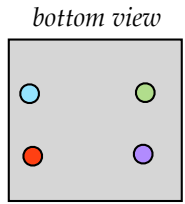


LED pattern on Parrot Drone

- Goal: see at least 4 points from all directions.
- Here's a solution with 6 LEDS:



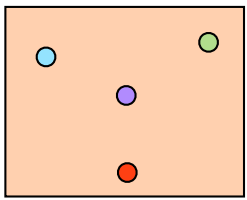


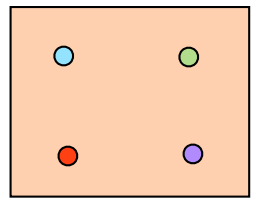


LED Test Pattern

- Goal: allow self-validation of reconstructed point pattern.
- Solution: use 4+ planar points.
- 3 points + planar constraint for reconstruction,
  1+ point for validation.

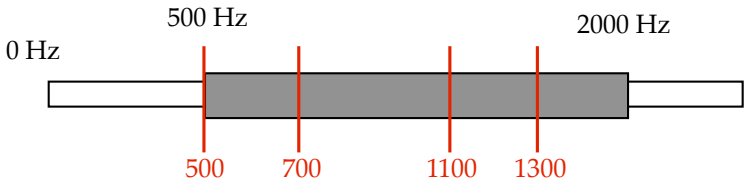
- What's the best pattern?





Choice of frequencies

- A possible research question.
- Do not choose frequencies that are multiple of each other, because the harmonics (due to missing events) can have a bad impact.
- Perhaps use **relatively prime** frequencies for minimum ambiguity: Given a band of allowed frequencies (e.g., [500Hz, 2000Hz]), choose a set of frequencies that are well spaced and relatively prime.



relatively prime frequencies

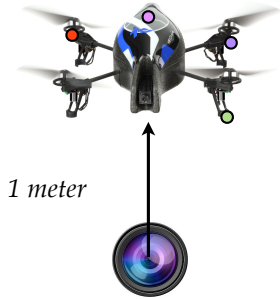
Data collection campaign

There are many variables influencing the results

- Variables:
  - Camera tuning (biases)
  - Lightning conditions
  - Distance to camera
  - Motion: “Straight” velocity + random motion
  - Background texture and distance
  - Number of LEDs; whether they go out of frame or not.
  - LED frequency, duty cycle
- Measurable results:
  - Regularity of sequence of plus/minus events
  - Overall tracking accuracy

Method: Decide on some nominal condition, vary only one parameter.
$O(cn)$ number of experiments, instead of $O(c^n)$.

Nominal conditions for scenario A



Scenario A conditions

Camera tuning (biases)

- "adjusts event threshold" nominal, down, up
- "balance between on and off"

Lightning conditions

- Artificial light, natural light, no light.

Distance to LED

- 1 meter, 0.5, 2

Motion: "Straight" velocity + random motion

- small motions, *fixed*, hovering, flip (!)

Background texture and distance

- Not applicable in this scenario (the background does not move)

Tracking nuisances

- All LEDs always visible, LEDs appear and disappear

LED frequencies

- 1) Nominal frequency range is 700 - 2000 Hz
- 2) Variation: frequency range is 700 - 1500 Hz
- "smartly chosen" without harmonics

LED Duty cycle

- 50%, no variations