ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

WP4/5: Vision-guided automated landing and relative positioning

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mycopter

http://www.mycopter.eu

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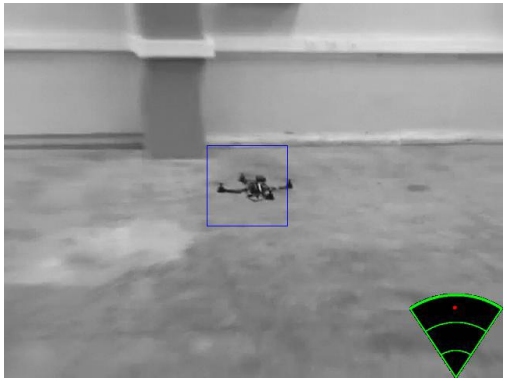
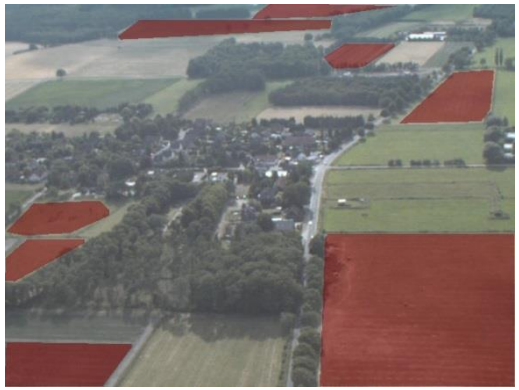
EPFL Computer Vision Lab. Tasks

- Vision-based relative positioning
  - Automated detection of neighboring aircraft



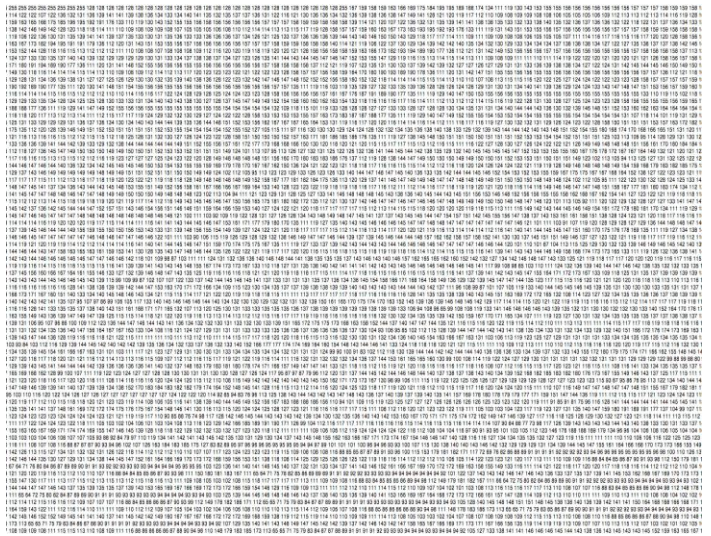
- Automatic landing place assessment
  - Efficient candidate landing site proposal system



Vision-Based Problem

- What are the technical challenges?

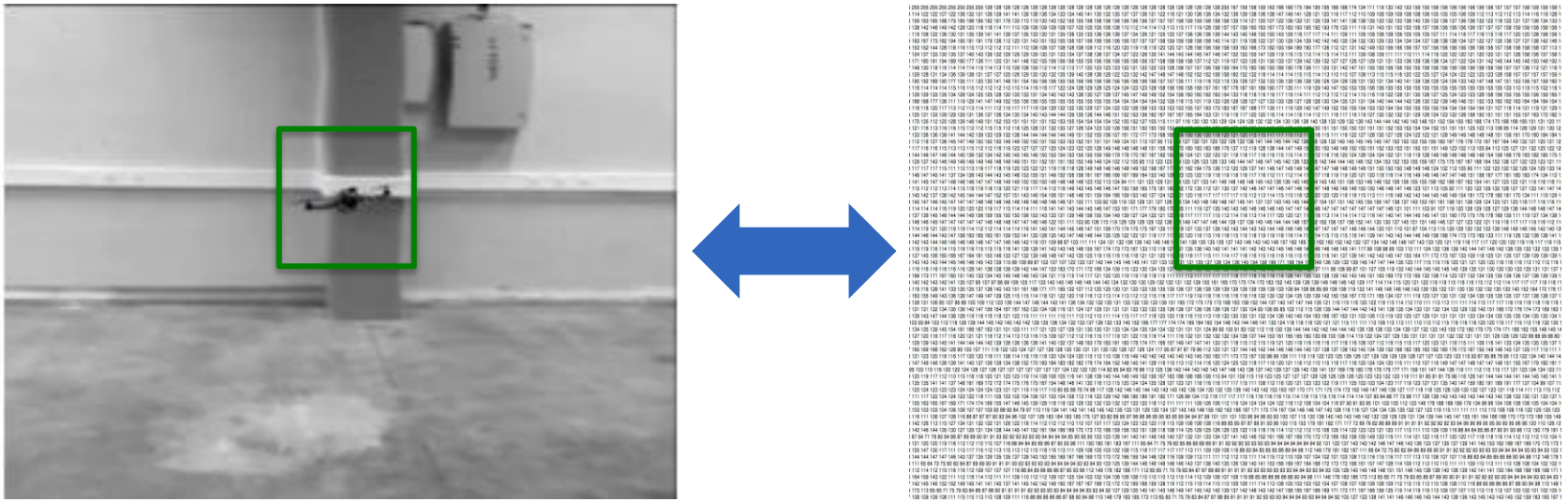
Video image



Computer Representation

Vision-Based Problem

- What are the technical challenges?

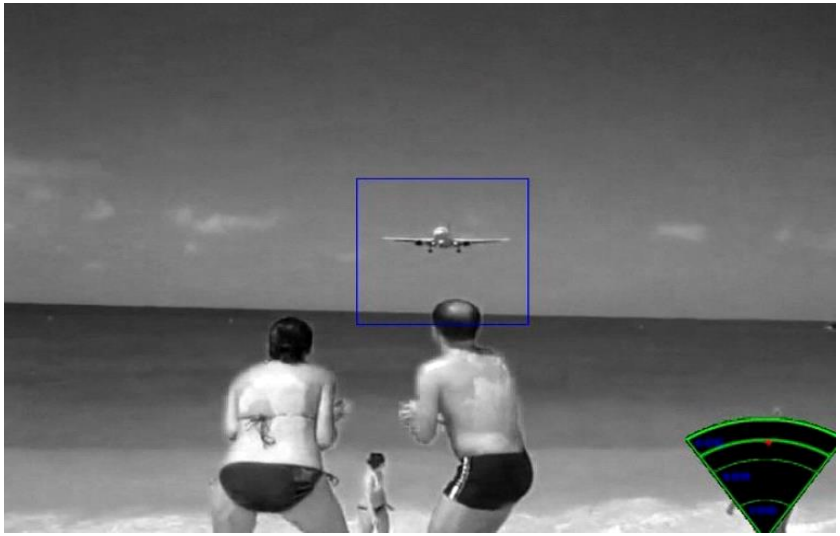


Video image

Computer Representation

Vision-Based Relative Positioning

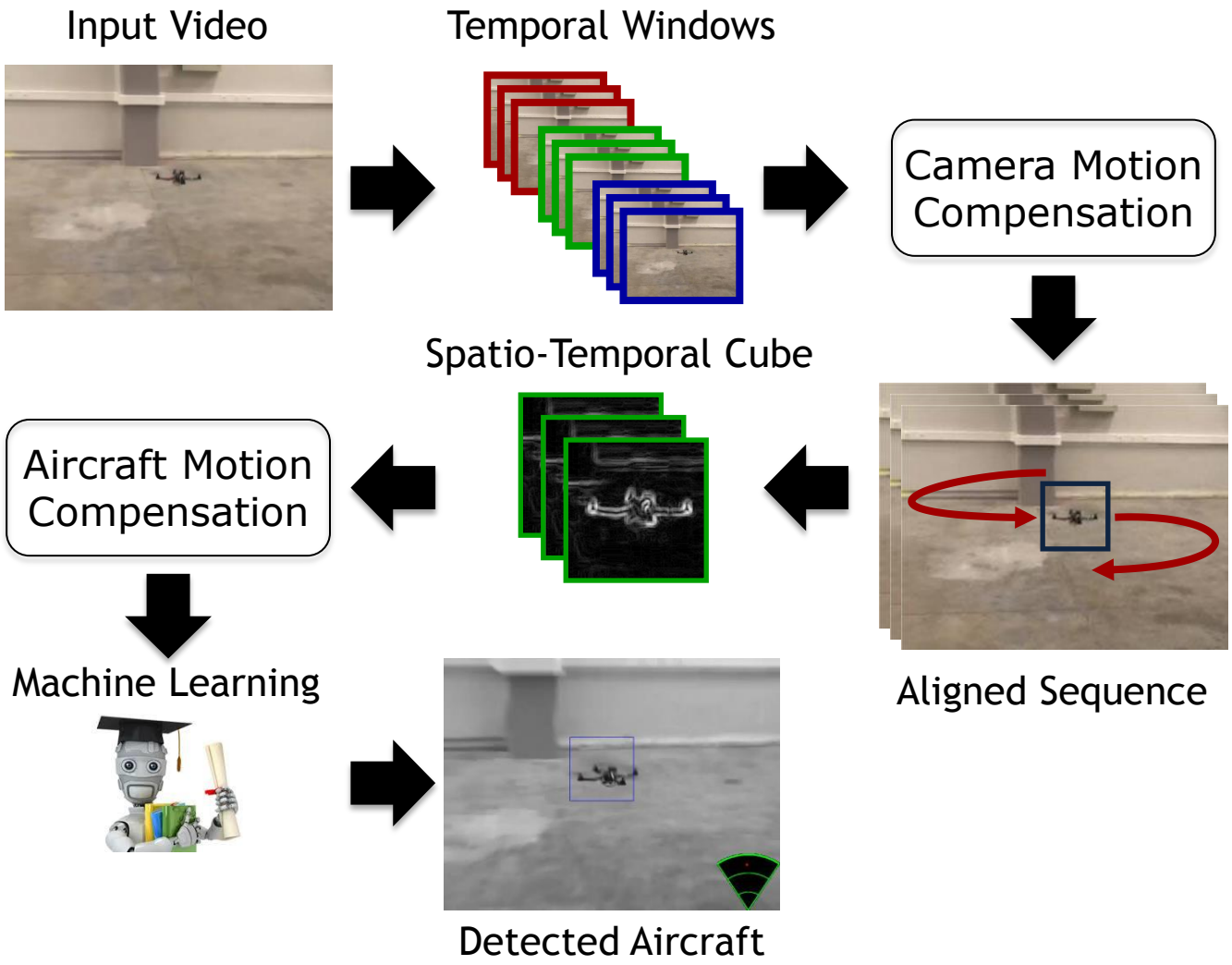
- Considered the detection of neighboring aircraft under two flight motion models: collision-course and general flight



Collision-Course

General Flight

Detection of Neighboring Aircraft in General Flight



Aircraft Detection Results

Automated Landing Place Assessment

- **Goal**: Quickly assess suitable landing places using only standard cameras and hardware

- **Challenges:**
  - Estimation of 3D geometry from a distant camera is difficult.
  - Human pilots consider many factors such as
    - surface type, slope and size;
    - potential obstacles;
    - season, weather conditions.
  - Near real-time performance is important.

What would a human pilot do?

- Considered relatively featureless, regularly shaped areas

Maximally Stable Extremal Regions (MSERs)

- Stable regions obtained by image thresholding

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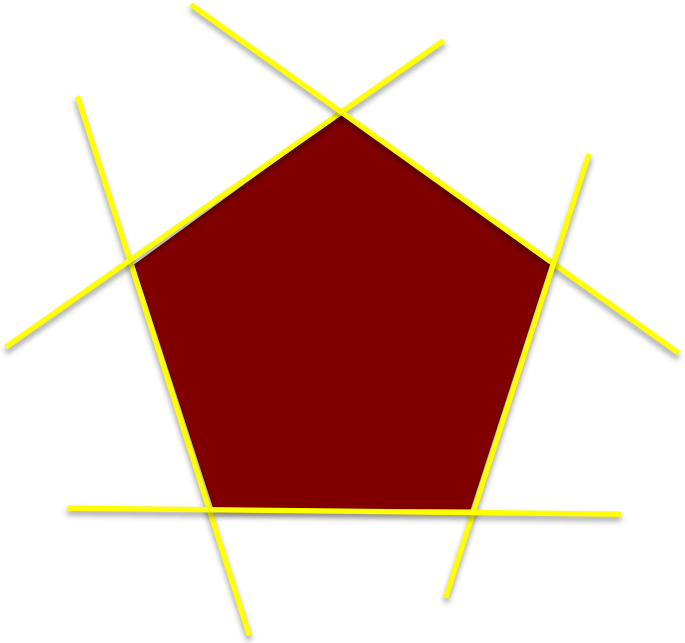
Original Image

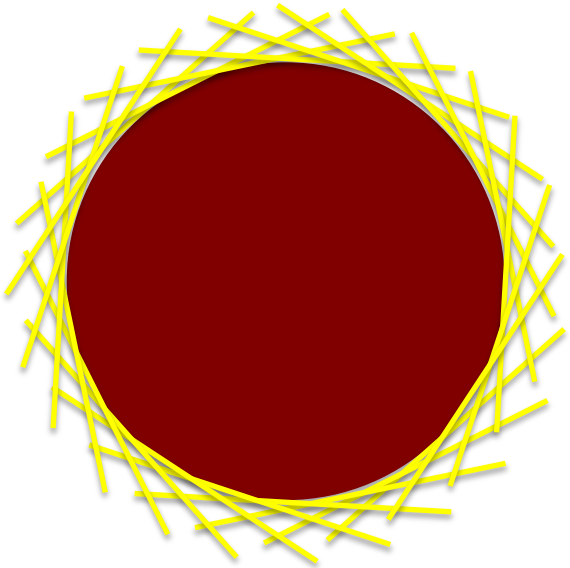
Constant Intensity MSERs

Our Approach: Polygonal MSERs

- Extend MSERs to find polygonal shapes

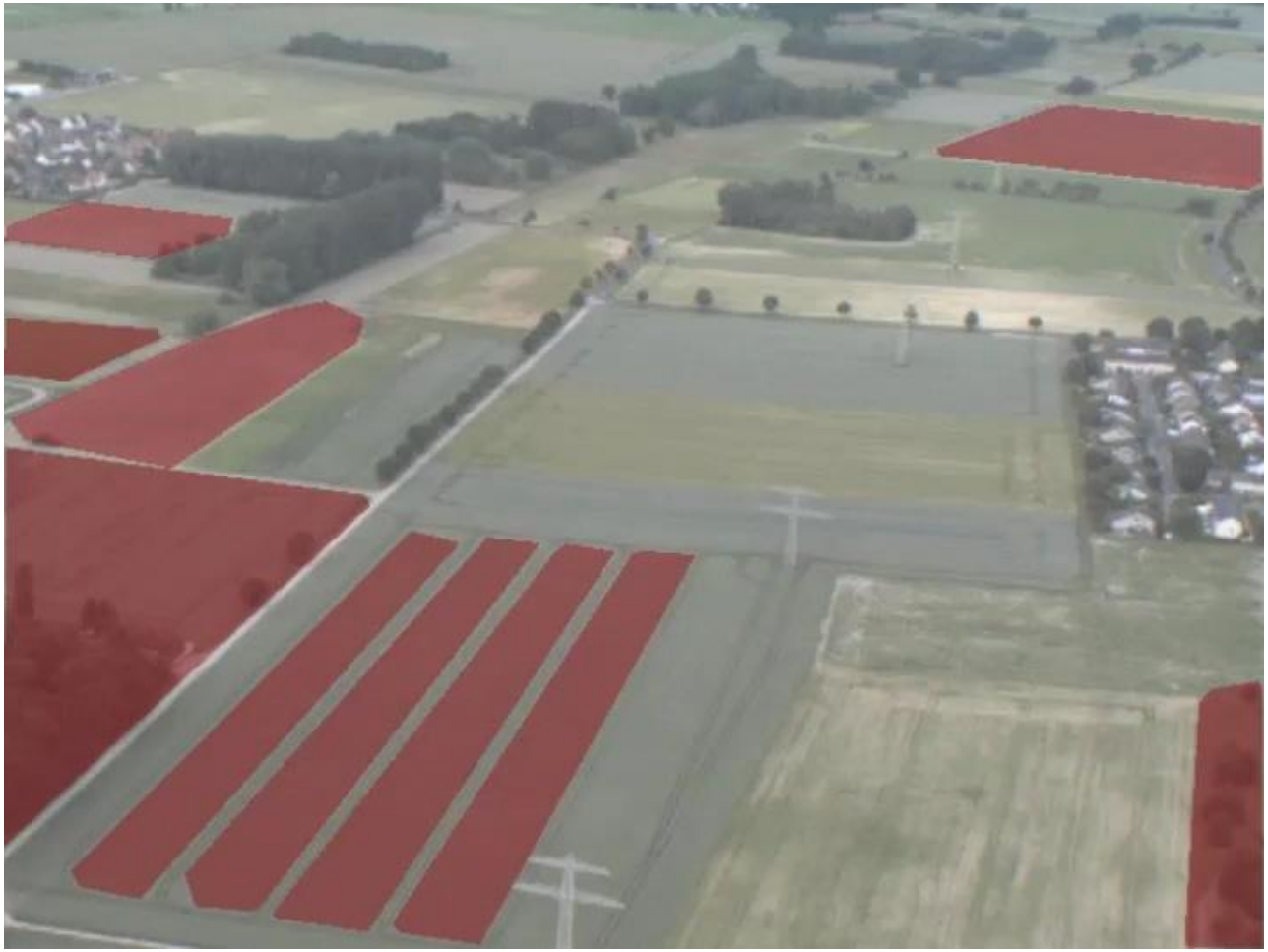


High regularity score



Low regularity score

Candidate Landing Site Detection



Summary

- Developed methods for the automated detection of both collision-course and general flight aircrafts
- Evaluated system across many datasets and different types of aircraft including UAVs and fixed-wing aircraft
- Proposed a candidate landing site proposal system based on finding regularly shaped, featureless regions as Polygonal MSERs
- Demonstrated landing site detection on the FHS helicopter

To learn more please visit our posters and demo.