Sensor Fusion on a mini Unmanned Vehicle

Integrating vision-based algorithms on an Parrot AR.Drone to autonomously follow linear shaped structures in a landscape.

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Outline

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National Aerospace Lab NLR

NLR is the main knowledge enterprise in the Netherlands in the field of aviation and aerospace.

Research Question

What vision-based algorithms perform successful in autonomously following linear shaped structures in a landscape with an Parrot AR.Drone?

Research Goal

The goal of this research project is to develop an algorithm on an Unmanned Aerial Vehichle that in the end can navigate autonomously over infrastructure.

Outline

Progress Overview

- Platform change.
- Set up the framework.
- Overview Aproach
- Implement vision-based algorithms.
- Integrate vision-based algorithms.

Platform change

Parrot AR.Drone instead of **AscTec Pelican**.

Reasons:

- AR.Drone has integrated Optical Flow (hovering).
- Framework is written for AR.Drone.
- AscTec Pelican does not have Optical Flow integrated.

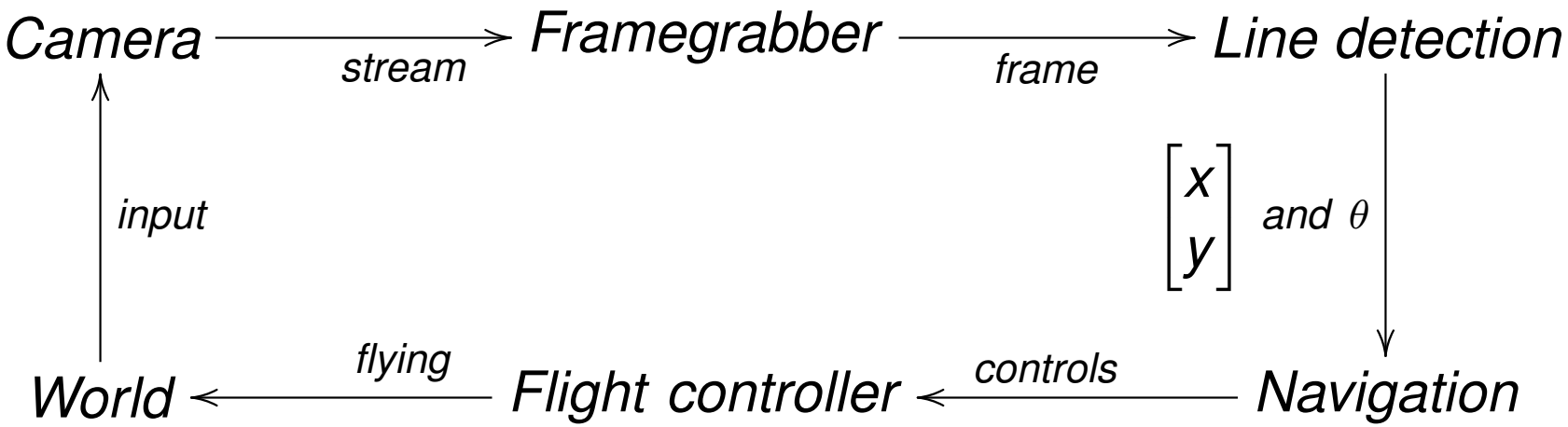
Side effects:

- AR.Drone carries a poorer camera.
- AR.Drone does not carry pan/tilt camera.

Setup the framework

- Framework of MSc. student N. Dijkshoorn. Provides:
  - Real-time SLAM.
  - Communication AR.Drone.
  - Communication USAR-SIM Simulator.
  - Various controllers (ie. 3D mouse or keyboard).
- Windows based.
- Image library (OpenCV).
- Source in C++.

Overview Line-Following Approach



Implementing vision-based algorithms

Line detection: Probabilistic/Randomized Hough Line Transform

- Less computational costs due geometric features of a line.
- Evaluates randomly selected points

Line selection: based on the features of the line (ie. length and slope).

Determine movement: Angle θ and transformation $\begin{bmatrix} x \\ y \end{bmatrix}$

Track line: using area of interest.

Video demonstration on dataset

Video: Probabilistic Hough Line Transform on Dataset Pelican

Integration of the vision-based algorithms

- Link vision-based algorithm to the framework.
- Determine action of the platform.

Video: AR.Drone following a line.

Outline

Planning

- Implement other vision-based algorithms.
  - BioMAV's approach.
  - Majidi's approach
- Improve flight actions of the line-following algorithm.
- Compare algorithms.
- Write Bachelor Thesis.

BioMAV's Approach

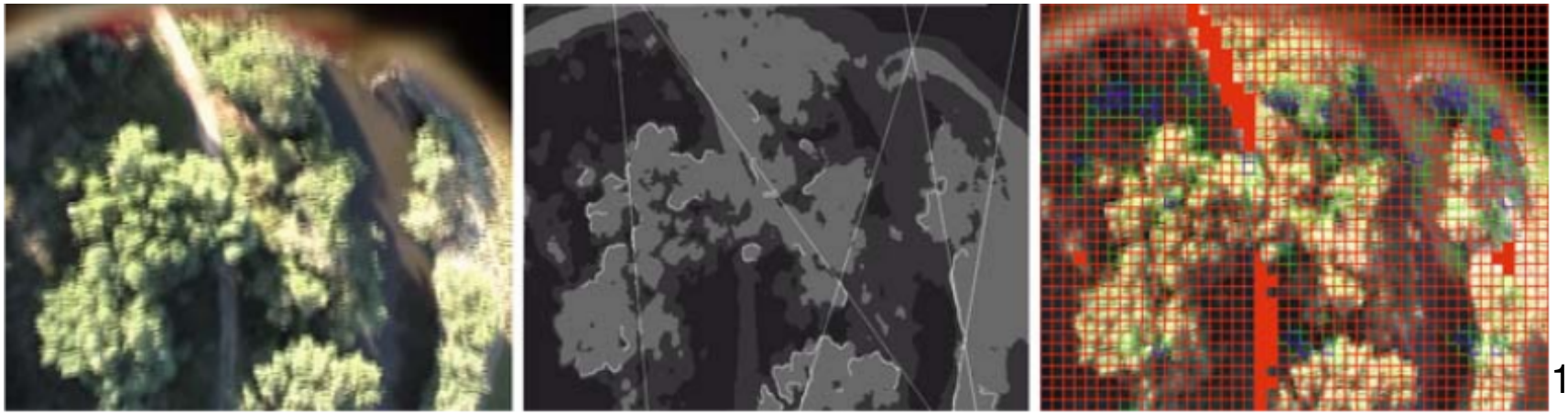
Combining:

- Enhanced Motion Detection Activation
- Quick shift segmentation (Edge detection)

Majidi's Approach

Combines

- Line Detection
- Texture Segmentation

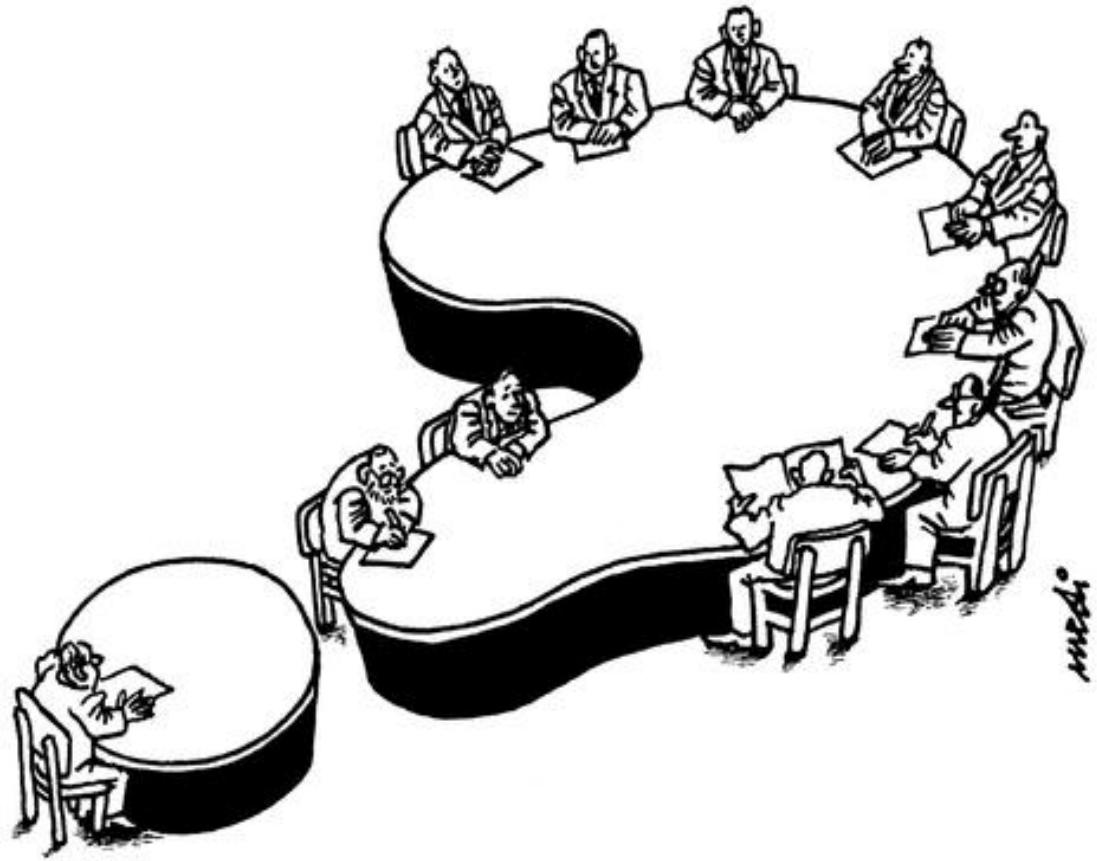


[1]

[1] [Majidi and Bab-Hadiashar, 2009]

Outline

Questions?



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