Data enriching

Jiri Horner

Optical Flow

Lucas-Kanade flow

Farneback flow

example

Problem: how to represent flow?

Optical Flow

Input:

video

Output:

textfile: for each frame of a video an array of floats representing flow

Monocular Visual Odometry

Input:

video

Output:

for each frame a motion vector in 3D

(resp position estimate + angular and linear velocities)

SVO: Fast Semi-Direct Monocular Visual Odometry

Christian Forster, Matia Pizzoli, Davide Scaramuzza*

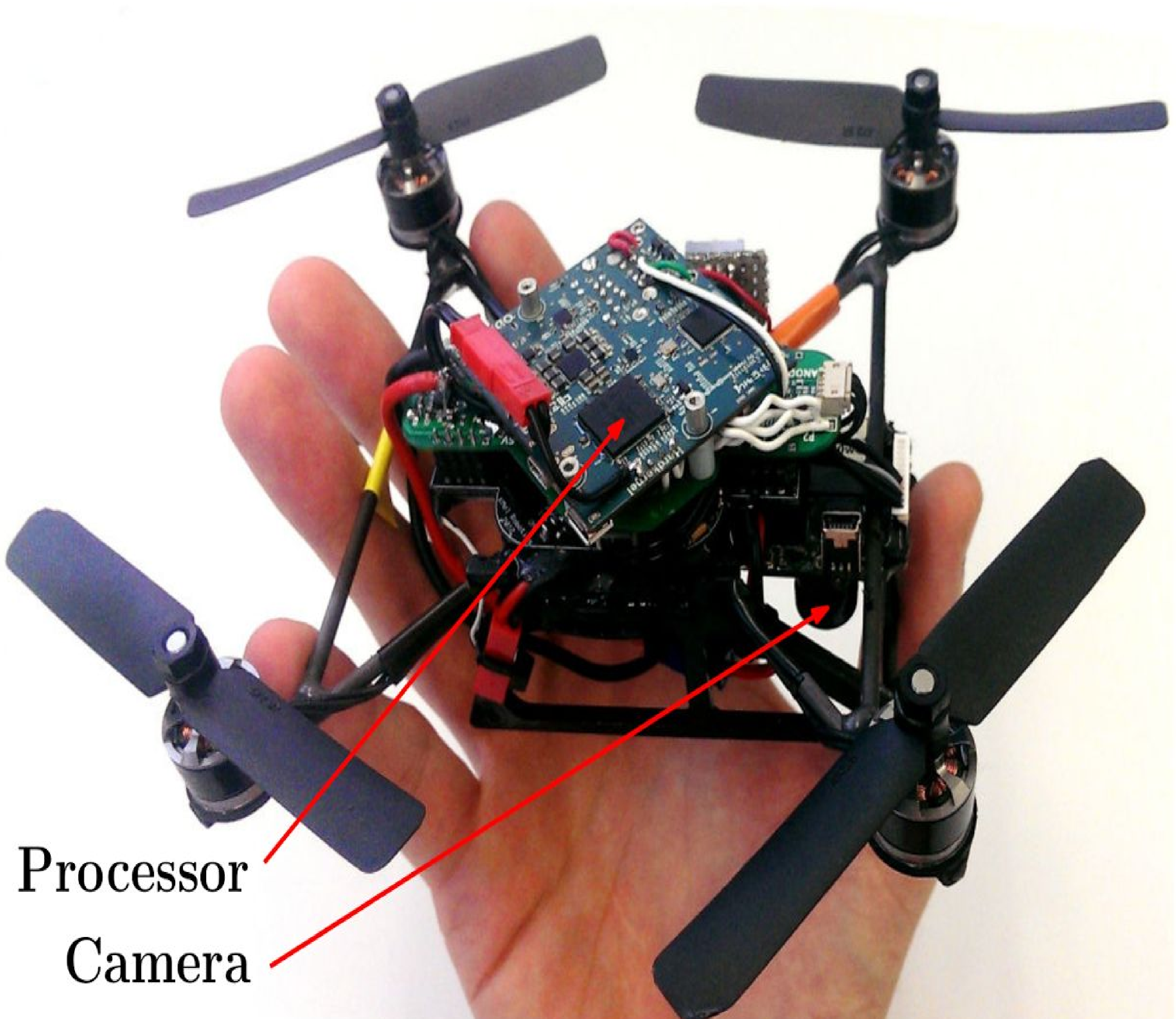
Abstract— **We propose a semi-direct monocular visual odometry algorithm that is precise, robust, and faster than current state-of-the-art methods. The semi-direct approach eliminates the need of costly feature extraction and robust matching techniques for motion estimation. Our algorithm operates directly on pixel intensities, which results in subpixel precision at high frame-rates. A probabilistic mapping method that explicitly models outlier measurements is used to estimate 3D points, which results in fewer outliers and more reliable points. Precise and high frame-rate motion estimation brings increased robustness in scenes of little, repetitive, and high-frequency texture. The algorithm is applied to micro-aerial-vehicle state-estimation in GPS-denied environments and runs at 55 frames per second on the onboard embedded computer and at more than 300 frames per second on a consumer laptop. We call our approach SVO (Semi-direct Visual Odometry) and release our implementation as open-source software.**

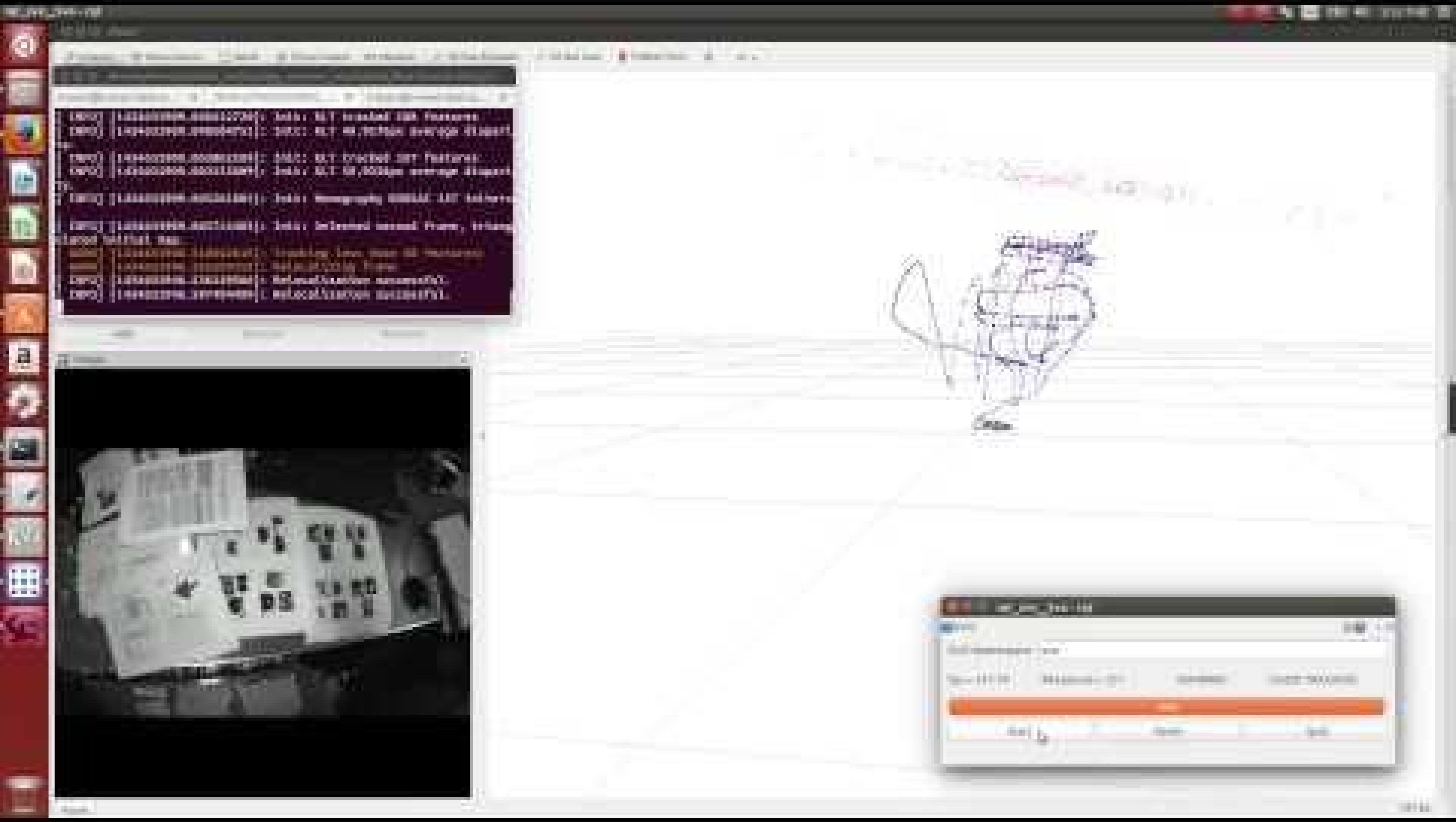
I. Introduction

Micro Aerial Vehicles (MAVs) will soon play a major role in disaster management, industrial inspection and environ-

a) Feature-Based Methods: The standard approach is to extract a sparse set of salient image features (e.g. points, lines) in each image; match them in successive frames using invariant feature descriptors; robustly recover both camera motion and structure using epipolar geometry; finally, refine the pose and structure through reprojection error minimization. The majority of VO algorithms [12] follows this procedure, independent of the applied optimization framework. A reason for the success of these methods is the availability of robust feature detectors and descriptors that allow matching between images even at large inter-frame movement. The disadvantage of feature-based approaches is the reliance on detection and matching thresholds, the neccessity for robust estimation techniques to deal with wrong correspondences, and the fact that most feature detectors are optimized for speed rather than precision, such that drift in the motion estimate must be compensated by averaging over many feature-measurements.

b) Direct Methods: Direct methods [13] estimate


Processor
Camera



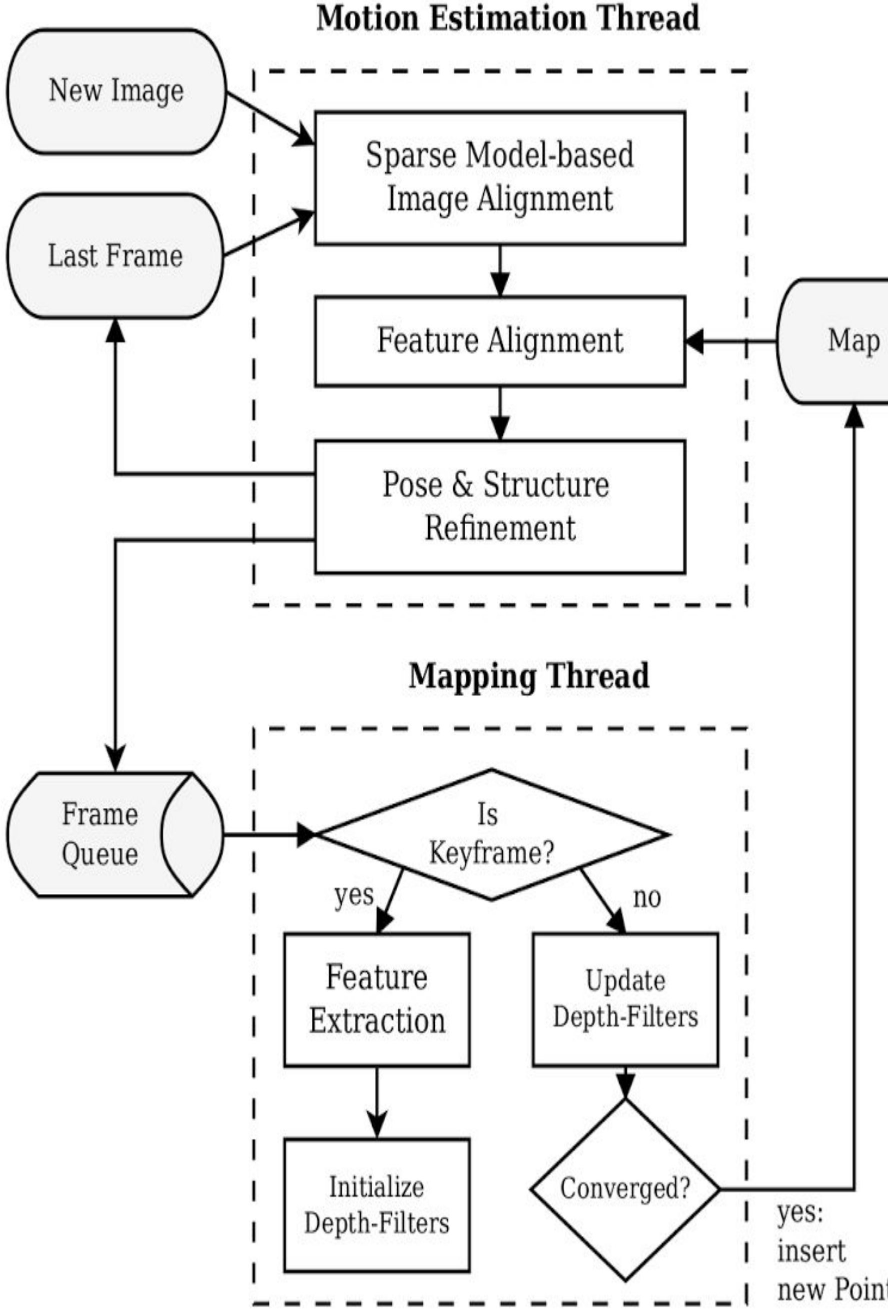


Fig. 1: Tracking and mapping pipeline