Visual Odometry Pipeline

Pascal Buholzer, Fabio Dubois, Milan Schilling, Miro Voellmy

January 6, 2017

Symbols

Contents

1 Introduction

The aim of this mini project is the development of a visual odometry pipeline. This pipeline takes the consecutive gray-scale images of a single digital camera as input. Therefore the pipeline developed in this mini project is a monocular visual odometry pipeline.

The output of the pipeline is the position of the camera in relation to its initial position for each frame.
keywords: (VO, sequential, monocular, markov assumption)

2 Implementation

2.1 Framework

This pipeline was developed in MATLAB. Since the group consists of four students, a Git repository was used to be able to work on different files simultaneously, and to enable version control. (keywords: MATLAB, Git)

2.1.1 Coordinate Frames

In this mini project the coordinate frames were defined as shown in fig. 1. The camera coordinates are in a way oriented, that the x-y plane lies parallel to the image plane, while the z-axis is pointing towards the scenery. The world frame however is oriented in such a way that the x-y plane is parallel to the ground and the z-axis is pointing upwards. The origin of the world frame is at the same location as the origin of the first boot-strap image.

Transformation between frames are described by homogenous transformation matrices. T_{AB} maps points from frame B to frame A.

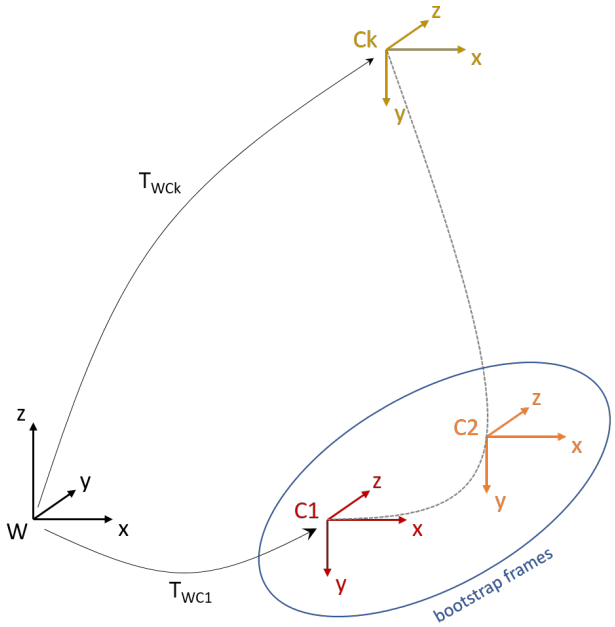

Figure 1: Coordinate Frames

2.1.2 Pipeline overview

As shown in fig. 2 the pipeline consists mainly of three parts, a bootstrap, the initialisation and the continuous operation. In section 2.2 and section 2.3 the initialisation and the continuous operation are described in detail.

2.1.3 Options and parameters

(keywords: parameter handling, GUI)

2.2 Initialization

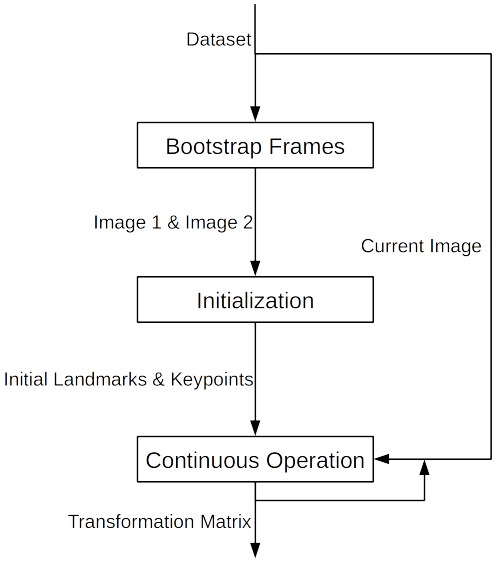

Figure 2: Rough Flow chart

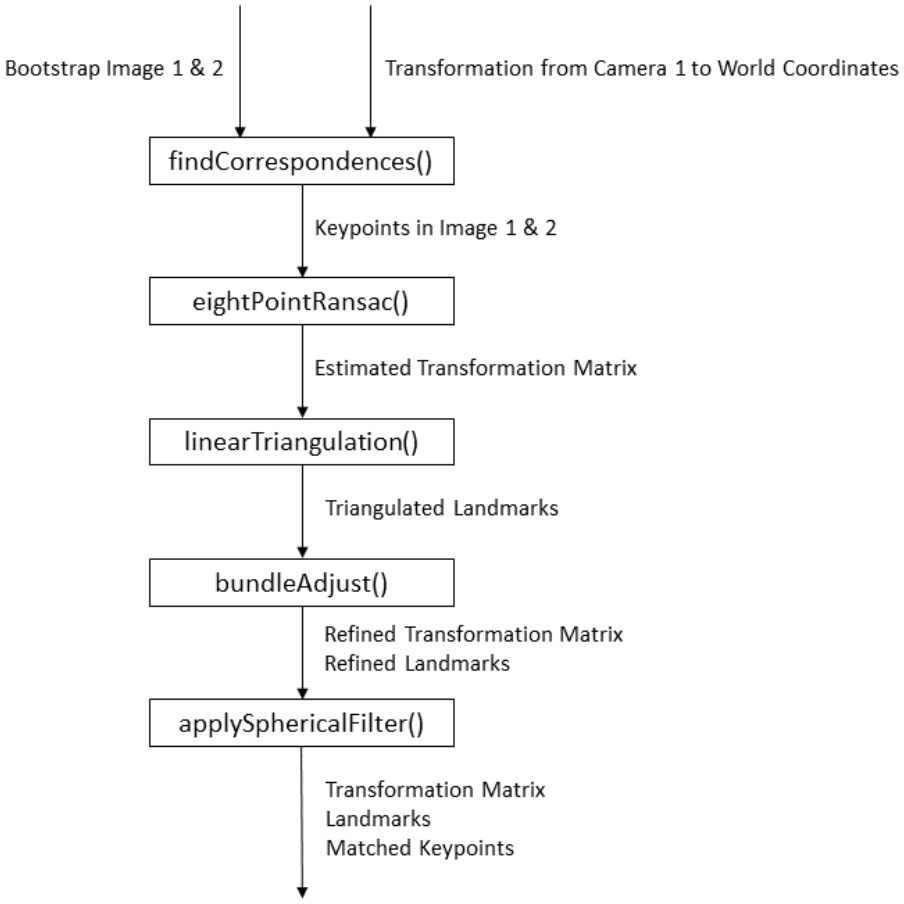

Figure 3: Init Flow chart

2.3 Continuous Operation

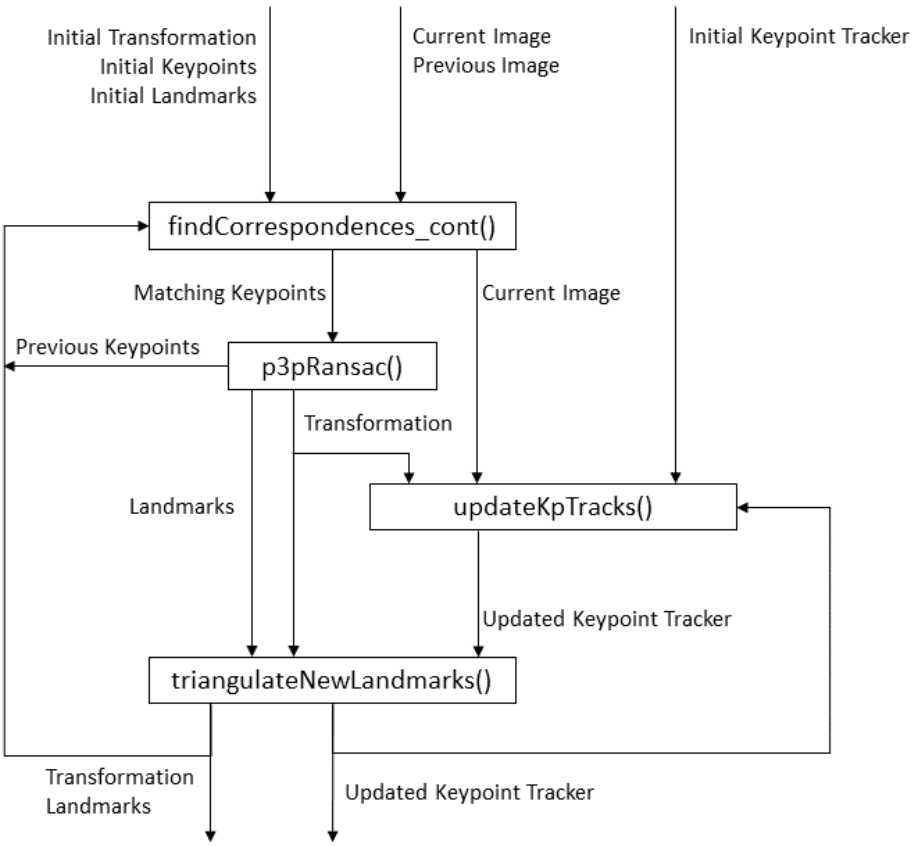

Figure 4: Cont Flow chart

3 Results

3.1 Overall performance

(keywords: Real time ness, comparison to groundtruth, compare different datasets Impact of features)

4 Discussion

What have we learned, what worked?
Possible future work, improvements (loop closure, ...)

5 Conclusion