Influence of Corner Detectors in the Process of 3D Modeling from Video

Svetlana Mijakovska[1], Roberto Pasic[2], Ivo Kuzmanov[3]

[1]University St. Kliment Ohridski, Faculty of Technical Science, Makedonska falanga 33, 7000 Bitola, R. Macedonia svetlana.mijakovska@uklo.edu.mk

Abstract –The purpose of this paper is to describe the impact of the choice of corner detector in the process of 3D modelling from video. Reviewed several types of corner detectors and made an examination of various types of objects in order to choose the most appropriate detector. This is an important step in the process of 3D modelling from video, because the accuracy of the detected points depends on the quality of the resulting 3D model.

Keywords – 3d model, corner detector, key points, descriptor.

1. Introduction

3D models are used in many fields such as animation, computer games, virtual reality, film industry, computer vision, etc. The generating of 3D models can be done in many ways, from a series of images, manually and also 3D models can be generated from video [2].

The video as input data has the advantage because of the high quality that you can get and its flexibility. The process of 3D modeling of the video consists of several steps [1]:

- feature detection and matching,
- structure and motion recovery,
- stereo mapping and
- modelling.

3D models actually represent 3D objects as a collection of points in 3D space, connected with geometric objects (triangles, lines, curved surfaces, etc.). So, the first task is getting the cloud of 3D points that will then be connected to a network through a process of triangulation (which is a standard process for converting a set of points in the polygonal model). The cloud of 3D points obtained from the reconstruction of the video is affected by several factors that affect the feature detection and matching. Therefore, using corner detectors (as points of interest) and descriptors that are prerequisite to connect the points from one frame of video.

Feature matching between the frames are done by a variety of techniques, but should be avoided unnecessary points (outliers) that have a negative impact on the final 3D model.

In this paper we elaborate several corner detectors: Förstner, SUSAN and Plessey.

2. Corner detector

3D modelling from video is process that require to extract information from relating two or more frames from video (images). For example, if two successive frames in a video sequence taken from a moving camera can be related, it is possible to extract information regarding the depth of objects in the environment and the speed of the camera. One imagecan be relating withanother images by matching onlylocations in the image that are in some way interesting. Such points are referred to asinterest points and are located using an interest point detector. Finding a relationshipbetween frames (images) is then performed using only these points.

Many different interest point detectors have been proposed with a wide range ofdefinitions for what points in an image are interesting. Some detectors find points of highlocal symmetry, others find areas of highly varying texture, while others locate cornerpoints. Corner points are interesting as they are formed from two or more edges andedges usually define the boundary between two different objects or parts of the sameobject. Many corner detectors have been developed and this website investigates some ofthe more important ones [3].

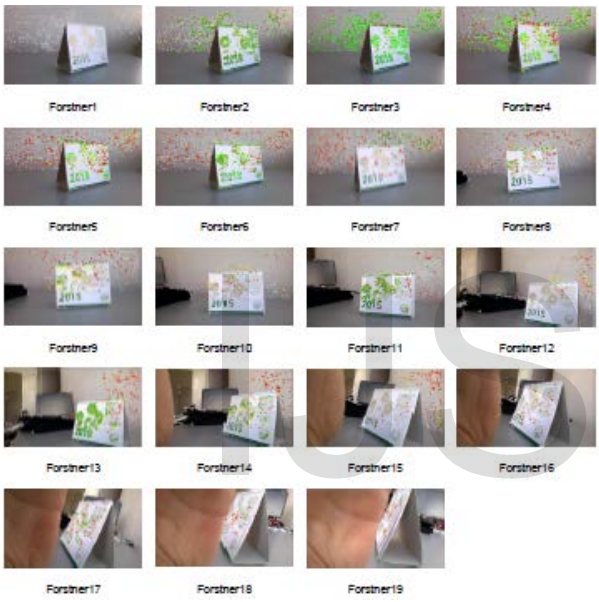
In addition to the paper we reviewed three corner detectors (Förstner, SUSAN and Plessey) and made comparison in order to choose the best for the process of 3d modelling from video.

3. Experimental part

For the experimental part we take video of different objects using hand held camera. We use Voodoo Camera Tracker program which calculates the camera parameters and reconstruct 3D scene from a sequence of images.The goal is compare corner detectors taken the speed and root-mean-square error - RMSE(difference between the values of the model and the values obtained in a classical way) [4], as a first step in the process of 3D modeling from video and getting point cloud.

Example1. Triangle as object

1.1 Förstner detector



1.2 SUSAN detector

1.3 Plessey detector

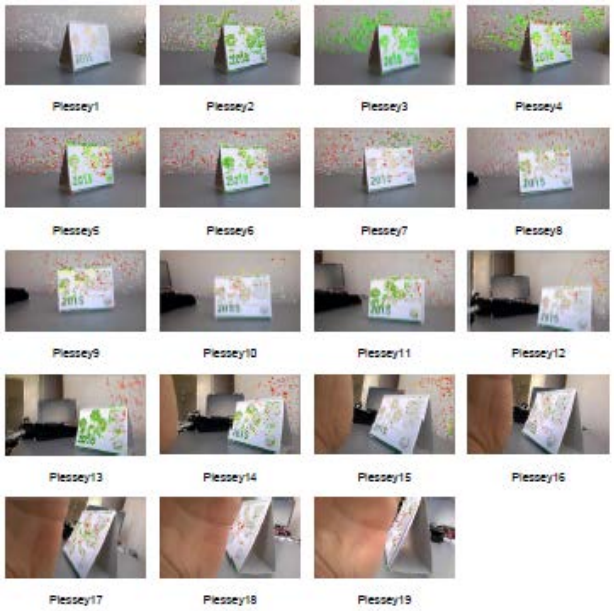
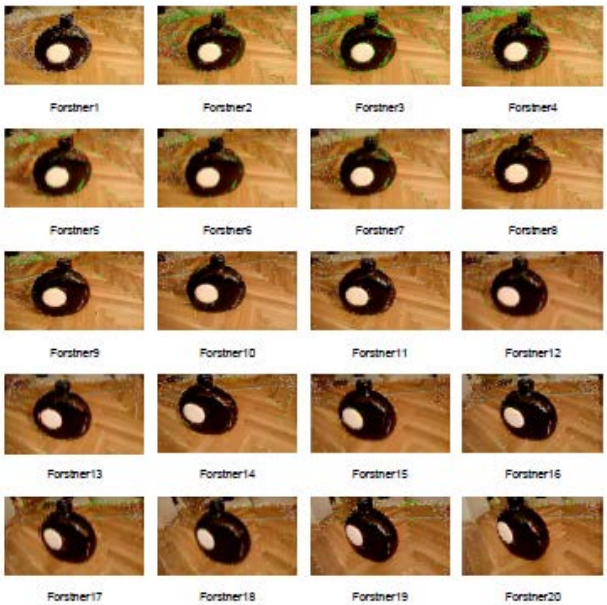


Table 1.Comparison of corner detectors

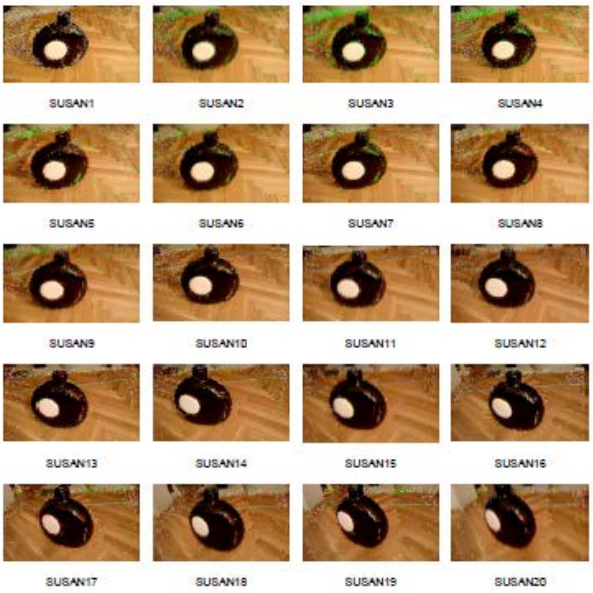
Corner detector	Speed	RMSE
SUSAN	80s	0,854275
Plessey	85s	1,804651
Förstner	70s	0,792652

Example 2.Curved object

2.1 Förstner detector



2.2 SUSAN detector



2.3 Plessey detector

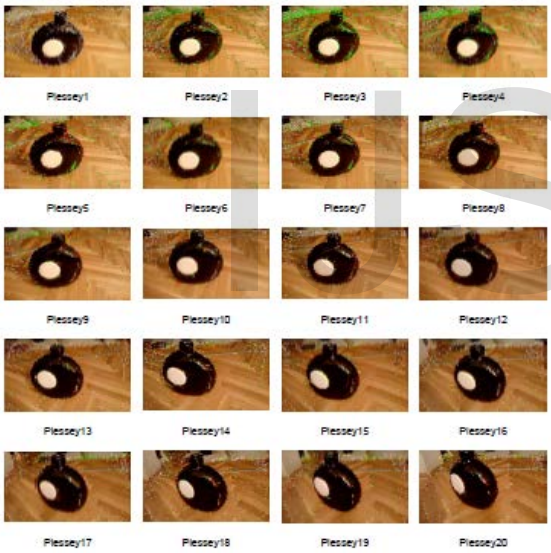


Table2.Comparison of corner detectors

Corner detector	Speed	RMSE
SUSAN	80s	0,620318
Plessey	60s	0,704774
Förstner	55s	0,578689

Example 3. Star as object

3.1 Förstner detector

3.2 SUSAN detector

3.3 Plessey detector

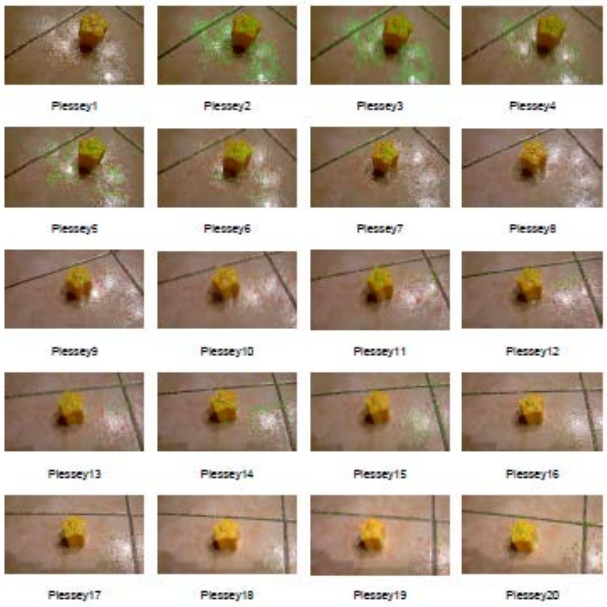


Table3.Comparison of corner detectors

Corner detector	Speed	RMSE
SUSAN	80s	0,701647
Plessey	60s	0,413004
Förstner	55s	0,336523

4. Conclusion

The process of 3D modelling from video consists of four main tasks:

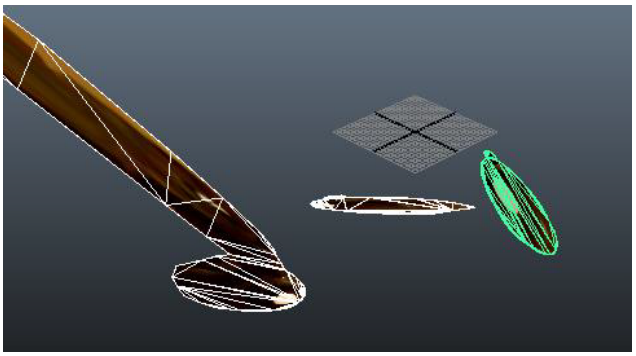
1. Feature detection and matching.
2. Structure and Motion Recovery.
3. Stereo Mapping.
4. Modelling.

In this paper we describe the first step because it is essential for getting accurate 3d model from point cloud. The accuracy of 3d model depends of key points (the best points that describe the object), and less occurrence ofoutlies (points that not belong to the object).

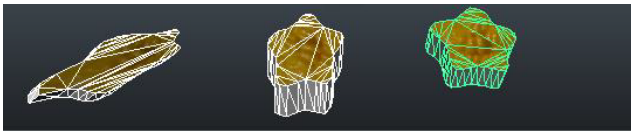
From the tables of comparison of corner detectors we can see that Förstner detector is better than SUSAN and Plessey,in terms of speed andRMSE. That means that Förstner detectorprovides the best key points that describe objectand we get accurate 3D model.

Example 3. Generated 3D model from Example.1using Plessy,SUSAN and Förstner detector.

Example 4. Generated 3D model from Example.2 usingPlessy,SUSAN and Förstner detector.



Example 5. Generated 3D model from Example.3 using Plessy,SUSAN and Förstner detector.



Notes should be that there are several limitations to this step and the appearance of different contrast, ghosting, the occurrence of moving objects, etc. All this can be used for further research.

References

[1]. S.Mijakovska, I.Nedelkovski, F.Popovski, 2014, Overview of the process of 3D modelling from video, International Journal of Engineering Sciences & Emerging Technologies, Dec. 2014, ISSN: 2231 – 6604 Volume 7, Issue 3, pp: 680-686 ©IJESET.

[2].S.Mijakovska, I.Nedelkovski, F.Popovski, 2014, Generating 3D model from Video, Advanced Computing: An International Journal (ACIJ), Vol.5, No.5/6, November 2014.

[3]. C. Schmid, R. Mohr, and C. Bauckhage. (1998) Comparing and Evaluating Interesting Points, International Conference on Computer Vision, pp. 230-235.

[4]. T. Chai and R. R. Draxler, Root mean square error (RMSE) or mean absolute error (MAE)? – Arguments against avoiding RMSE in the literature.
[5]. Roberto. Pasic, Ivo Kuzmanov, SvetlanaMijakovska. "Print Quality Control Management for Papers Containing Optical Brightening Agents", ISSN 2229-5518,IJSER, Volume 7, Issue 2, Feb 2016, pages 271-274.

Corresponding author: Svetlana Mijakovska, Assistant Professor
Institution: Faculty of Technical Science in Bitola, R. Macedonia
E-mail: svetlana.mijakovska@uklo.edu.mk