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3D Reconstruction from Multimodel Satellite Data

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Abstract: *3D Reconstruction has been a field of interest for multiple disciplines, and in the past decade, many researchers have devoted their studies to improve on state-of-art automated methods used for 3D Reconstruction. 3D models have their application in solving numerous visualization problems and a large number of undertakings beyond visualization. In this paper, we conduct a short survey of research in 3D Reconstruction of Satellite data, and finally, we propose a workflow that will provide a direction for future researchers in generation 3D models of Satellite Data using Deep learning techniques. The workflow includes the use of CNN for object segmentation and use of GAN for DSM or height map construction and 3D model generation.*

Keywords: OpenCV (open source computer vision),Tensor flow, keras

I. INTRODUCTION

3D City models with buildings being its prominent feature have vast use cases such as Visibility Analysis, Estimation of Shadows Cast by Urban Features, Visualization for Navigation, Urban Planning, Forecasting Seismic Damage, Flooding, Change Detection, Forest Management, Archology, etc. in which visualization plays an important role makes 3D reconstruction of city models an essential Task. The primary focus in both of these use cases is to make the process less reliable on humans and also be less computationally expensive. The development of deep learning techniques using this method has an advantage over the others in terms of quality and efficiency. Each of these stages in the workflow has been more or less enhanced using deep learning. In this paper, works in deep learning have contributed to their development. We primarily focus on remote sensing and usage of Satellite and Aerial Images. However, the other kinds of data for 3D city modelling. The general workflow observed in many of the previous research for 3D city model generation includes; Data Acquisition, Height Map Construction, Object Detection ,3D reconstruction, LOD enhancement. Most of the stages of development heavily on algorithms and most certainly require human intervention. There also has been research in with 3D models can be generated without the construction of DSMs using shallow classifiers and predictors. However, most of the 3D reconstruction pipelines heavily rely on Height maps to achieve higher accuracy.

II. PROPOSED SYSTEM

We propose the methodology by creating 3D models using SURF and SIFT features. The user provides the satellite image as input. First the satellite images are collected and stored in the database. Then the objects are recovered and used to create the 3D reconstruction model. This model is provided as output. The methodology involves 3 important steps for the 3D reconstruction of satellite images.

III. METHODOLOGY

The methodology involves 3 important steps for the 3D reconstruction of satellite images.

Step 1: Processing of Satellite Images

In the first step, satellite images are processed to obtain important local features such as SURF and SIFT features. This step further involves seed points selection, gridding, resampling, normalized DEM construction and image features correspondence.

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Step 2: Detection of Objects

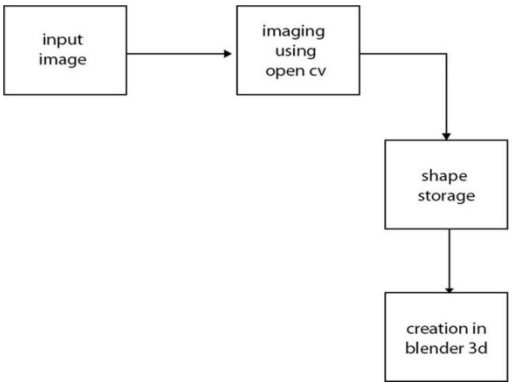
Second stage detects and recovers the object in the 3D model. This step involves following sub-stages: Image Matching, Positional properties check and model construction.

Step 3: Object Recovery

Third step recovers the objects using 3D reconstruction model.

III. SYSTEM ARCHITECTURE

The system architecture is similar to an object's blueprint. It is a theoretical framework for the systematic integration of physical systems and business logic. It illustrates the system's structure, viewpoint, features, and functionalities. It is a method of picturing the desired system so that people can easily understand it. The system architecture is the fundamental framework for a system that incorporates its constituent parts, how they are related, and the science behind their creation.



IV. CONCLUSION

In this paper, we review past and current practices used at various stages of 3D reconstruction of satellite and aerial images. Since the emergence of various deep learning techniques the performance at individual stages and also as a whole has increased. We reviewed various deep learning architectures, GAN and CNN in particular that have outperformed algorithms like SGM for stereo processing and 3D modeling and manual scene parsing. We also review the importance of scene segmentation for 3D modeling and that semantic information can be used to further enhance the 3D modeling process and 3D modeling should not be viewed only as a geometric task. The use of deep learning is still young and since the development of GAN lot of semi-automated or CAD-dependent tasks can be automated. We also demonstrated the basics of GAN and finally provided a workflow using GANs and CNN 3D reconstruction that can be further explored. We provided a review regarding each of the stages and finally proposed our own workflow that can be helpful for future.

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