19-20

3D Reconstruction from Stereoscopic Satellite Images

Tanmay Gatle1, Manasi Ladkat2, Anurag Kolhe3, Sunil B. Mane4, Rohini Sarode5
[1,2,3]*Department of Computer Engineering and IT, College of Engineering Pune, Pune, Maharashtra, India*
[4,5]*Assistant Professor, Department of Computer Engineering and IT,*
College of Engineering Pune, Pune, Maharashtra, India

Abstract- We develop a Web Tool for 3D Reconstruction of Satellite Images. We take input as several images of a single site and generate a resulting 3D model of the same site. This method uses local affine camera approximation for processing, and thus generates 3D models of small areas only. Usually, if the images of a single site are taken on different dates or in different seasons, then there are many changes in vegetation. Hence, the resulting 3D model will not be as accurate as compared to the model we would have generated by inputting images on a single date. However, our method generates 3D models with significant accuracy even if the images are taken on different dates or in different seasons. For this, we propose a Pair Selection criterion which solves this problem to a greater extent. We select a good stereo pair of images and generate a DEM from that pair. Similarly, some few good pairs are found by pair selection and resulting point clouds are aligned and fused together. Hence, it shows that inputting a large number of images of a single site and refining the 3D model by pair selection gives a 3D model which is as accurate as a single same date stereo pair.
Keywords – Stereoscopic, Satellite, Rectification, Triangulation, Point Cloud

I. INTRODUCTION

The availability of high-resolution satellite images has increased in recent years. Space borne sensors like QuickBird and IKONOS provide not only for high resolution and multi-spectral data but also for the capability of stereo mapping. The use of stereoscopic imagery and other sensor models such as rational function models can be used for 3D reconstruction of satellite imagery with accurate depth. The most important applications of 3D reconstruction are in Defense and Smart City modeling and can be used to keep an accurate account of the suburban and rural areas. These 3D models can also be used for disaster simulations like earthquake and flooding, security evaluation, watch over illegal constructions, pollution monitoring, and environmental planning. Other areas of application are change detection, cartography and large-scale measurements such as assessment after natural disasters and forest evolution. The images obtained from satellites have led to more accurate maps of the world being generated. The use of more advanced technology has also increased the accuracy and quality of the pictures obtained. Due to a mass of satellites available, many sites are even surveyed several times a year. Most of the images were multi-date images. Although not much change is observed, a closer look at the pictures shows a significant difference in vegetation and changes in the sky as per the climate. The goal of this project is to present an application which takes as input a variety of satellite images belonging to a particular site and to compute the best possible 3D model with the least computational cost.

1.1 Coordinate Systems –

In this project, we need to define geographical locations in terms of its relative coordinates corresponding to the earth, i.e., the geographical coordinates. For this, we use a coordinate reference system (CRS) where the coordinates are defined in terms of latitude, longitude and altitude.
To define the location of a particular geographical point on the image we use the term pixel coordinates. It defines the location of a pixel in the image uniquely. A digital image consists of row and columns of pixels. The pixel coordinates are a multidimensional array consisting of the row number and column number of the position of the pixel.

1.2 Dataset –

The dataset provided by IARPA Multi-view Stereo 3D Mapping Challenge is considered for the project. It consists of 50 DigitalGlobe WorldView-3 panchromatic images from its sample set of publicly available images. The images were acquired over a period of 14 months and have a 30 cm nadir resolution. The images are affected by the climate changes, the clarity of the images from the winter months is considerably lower. While using the dataset we consider an area described by geographic coordinates to be the area of interest (AOI). We want to focus on this part of the image for 3D reconstruction. The AOI in each of the images of the dataset is considered for further computations.

Published: 17 February 2020

Remote sensing and machine learning for crop water stress determination in various crops: a critical review

Shyamal S. Virnodkar, Vinod K. Pachghare, V. C. Patil & Sunil Kumar Jha

Precision Agriculture **21**, 1121–1155 (2020)

Abstract

The remote sensing (RS) technique is less cost- and labour- intensive than ground-based surveys for diverse applications in agriculture. Machine learning (ML), a branch of artificial intelligence (AI), provides an effective approach to construct a model for regression and classification of a multivariate and non-linear system. Without being explicitly programmed, machine learning models learn from training data, i.e., past experience. Machine learning, when applied to remotely sensed data, has the potential to evolve a real-time farm-specific management system to reinforce farmers' ability to make appropriate decisions. Recently, the use of machine learning techniques combined with RS data has reshaped precision agriculture in many ways, such as crop identification, yield prediction and crop water stress assessment, with better accuracy than conventional RS methods. As

Heterogeneous Data Fusion for healthcare monitoring: A Survey

Shrida Kalamkar[1], Dr. Geetha Mary A.[2],
[1]Research Scholar, SCOPE,VIT University, TN, India
[2]Associate Professor, SCOPE,VIT University, TN, India

Abstract: **Internet of Things (IoT) data fusion is underpinning numerous applications. However, data analytics for this is still challenging predominantly due to heterogeneous IoT data streams, unreliable networks, and ever increasing size of the data. Pervasive healthcare monitoring using body sensors and wireless sensor networks is one of the growing area in IoT data analytics. These healthcare applications produce a large amount of data from multiple heterogeneous healthcare devices. This heterogeneous data can be fused for advanced statistical analysis to develop deeper clinical understanding of a particular disease. Fusing data from diverse sources like clinical repositories, sensory devices, recorded signals, numerical measurements, narrative or textual data is very important for both patients and healthcare providers. However, with the increasing number of sensory devices, the complexity of data fusion is also increasing. Various issues like complex distributed processing, unreliable data communication, uncertainty of data analysis, data transmission at different rates have been identified. Taking into consideration these issues, in this paper we review the data fusion algorithms and present some of the most important challenges when handling this healthcare big data.**

Keywords: Data fusion, Internet of Things, Big Data, healthcare, analytics.

I.INTRODUCTION

With the emergence of Internet of Things, where all kinds of devices and systems are connected with each other, an enormous amount of data is continuously being generated in all walks of life. A significant portion of such data is being captured, stored, aggregated and analysed systematically without losing its "4V's" i.e. (Volume, Velocity, Variety and Veracity) characteristics. This big data Internet of Things revolution is under way in healthcare [1]. The term Internet of Things was firstly coined by Kevin Ashton in a presentation in 1998 [2]. He also mentioned that "The IoT has the potential to change the world, just as the Internet did. Maybe even more so.[3]". Then, MIT presented their IoT vision in 1999. Later, IoT was formally introduced by the International Telecommunication Union (ITU) by ITU Internet report in 2005[4]. The goal of the Internet of Things is to enable things to be connected anytime, anyplace, with anything and anyone ideally using any path/network and any service[5].

In recent years, healthcare applications such as home-based care, disaster relief management, medical facility management and sports health management have gained considerable interest[6][7]. Big data and pervasive technologies are increasingly used for biomedical and healthcare informatics research. Large amounts of biological and clinical data have been generated and collected at an unprecedented speed and scale. There are several technologies which allow handling large amount of data. But Despite the evolution of big data processing technologies such as Hadoop and Apache Storm and scalable infrastructure such as virtualised clouds, there still remains a significant gap as regards to heterogeneous data collection and real-time analysis based on defined quality of service (QoS) constraints[8]. Given the increase in volume, velocity, and variety of sensor data health care sensors, special techniques and technologies for analysis and inferencing are required.

Hence in this paper we first provide an overview of data fusion techniques. Later the importance of data fusion in healthcare application is highlighted. Section 4 discusses the survey of various healthcare sensor data fusion efforts and its importance towards IoT. Later issues in handling healthcare data are discussed. Section 5 highlights the data fusion framework metrics from healthcare perspective. Later section 6 discuss the applications of data fusion in healthcare. The Final section concludes the survey by highlighting the survey results and research gaps.

II.SENSOR DATA FUSION

Sensor data fusion is an essential and integral part of Internet of Things (IoT). Sensors are used in variety of applications, such as climate monitoring, smart mobile devices, healthcare, automotive systems, industrial control, traffic control. Data in IoT is dynamic and heterogeneous which leads to inadequacy of simple single-source analysis methods. Data fusion integrates multiple data and knowledge into a consistent, accurate and useful representation. This makes the data fusion to high-quality information to provide a reliable decision support. Data Fusion also leads to increase in the accuracy of information generated from multiple sources by reducing the uncertainty of data. The fusion of complementary information generated from multiple sources can provide more accurate information instead of single-source information. Confidence