

CHAPTER

8

CONSTELLATION RECOGNITION IN MOBILE APPLICATION ASSISTANT

Jumail Taliba and Athaya Maita Ghyskellya

8.1 INTRODUCTION

Constellation is one of many branches of astronomy that has become the focus of interest for many people. However, amateur stargazers often struggle to recognise constellations in the night sky due to various environmental factors. Using image processing to recognise constellations is considered possible by applying several methods of image processing. The proposed system of a mobile application for constellation recognition is designed to help amateur stargazers easily recognise constellations from images with the use of a mobile phone.

Four phases have been carried out. The first phase is to study and analyse the use of image processing in constellation recognition. The second phase is to design the system of the mobile application, then the third phase is the development of the mobile application, and finally, the fourth phase is system evaluation. The image processing and recognition processes that are carried out in this project are first image acquisition, then image enhancement, line drawing, and finally, the prepared image is fed to a convolutional neural network (CNN). Constellation recognition is the process of identifying and

interpreting patterns or shapes formed by specific elements within a dataset. In the context of mobile applications, it often pertains to the identification of constellations in the night sky but can also refer to recognising configurations of data patterns that serve unique purposes. Mobile application assistants have gained the ability to analyse vast amounts of data to make sense of the world for the user in contextually relevant ways.

8.2 UNDERSTANDING THE BASICS

Astronomy education has become a focus of interest for many students and amateurs (Rosenberg et al., 2013). It is a field of study that helps individuals understand their presence within the universe. While the origin of the earliest astronomical studies is uncertain but most probably came from ancient Greece, Mesopotamia, and ancient Egypt. A long way after the ancients discovered astronomy, modern astronomy has its popularity in public. Star constellations as mentioned in Liebe (2002), have caught many people's leadings them to study more about them. Astrology, the study of constellations, is one of the essential components of astronomy, has been studied for thousands of years, and is proven by how constellations and stars are named after the ancient gods.

Several guidebooks and applications for stargazing (i.e. Stellarium) are produced to help them distinguish constellations. However, guidebooks and applications only provide patterns and suggestions of constellations. The suggestions provided mainly include some information about the altitude location of the constellation Ji et al. (2014), at what time the constellation appears in the sky, and the pattern of the constellation. A problem occurs when amateur stargazers and students look up to the sky but cannot recognise any constellation, even though there are many stars visible and they have the technology guides. The issue may be caused by many environmental factors, such as the weather or the position of the stars.

The implementation of image processing and CNN have been recommended in Jamal et al. (2024), were able to recognise star

constellation patterns could be used as one of the solutions to improve the status quo and is considered possible since the positions of the stars are fixed in the sky, and most people nowadays have smartphones to take pictures. This sophisticated technology primarily relies on a combination of data acquisition, signal processing, and machine learning algorithms. Mobile devices come equipped with various sensors, including global positioning system (GPS), gyroscopes, and cameras, enabling them to gather data about their environment.

8.3 HOW IT WORKS IN PRACTICE

The integration of astronomy education with mobile technology opens new possibilities for interactive learning. This section presents a constellation recognition system worked in practice for mobile assistant applications, enabling users to identify celestial patterns through smartphone cameras. The challenges that have been addressed include star detection in noisy urban skies, pattern matching under rotational invariance, and real-time processing constraints.

The application serves as both an educational tool for astronomy enthusiasts and a practical example of pattern recognition in mobile computing environments. First, the preliminary investigation is conducted to get the requirements of the project. The gathered requirements are analysed to understand the flow.

A use case is produced during the analysis phase to see the boundary for the actor, and which use cases are accessible for the specific actor. Figure 8.1 presents the use case diagram for constellation recognition in a mobile application. There is only one actor, which is the user. This user can take a picture or choose a picture from the device. It will then be processed until finally the user is able to view the detected constellation.

The design is generated in this phase based on the requirements gathered. The goal of the design is to solve the problem addressed in detecting constellations from the image. Figure 8.2 shows the system architecture of this study.