A Comparative Study on Satellite Image Classification Using Various Deep Learning Techniques

Abdurashidova Kamola Turgunbaevna[1]
Assosciate professor at Tashkent University of Information Technologies named after Muhammad al-Khwarizmi, Department of Computer Systems E-mail: kamolabdurashidova@gmail.com

Abdukhakimov Fayzulla Kudratulla ugli[2]
Graduate student at Tashkent University of Information Technologies named after Muhammad al-Khwarizmi, Department of Computer Systems, abduhakimovfayzullo@gmail.com,

Chorshanbiyeva Sevinch Akramovna[3]
Undergraduate student at Tashkent University of Information Technologies named after Muhammad al-Khwarizmi, Department of Computer Systems chorshanbiyevasevinch1@gmail.com

ABSTRACT The satellite image classification procedure comprises categorizing the image pixel values. There are several approaches and procedures for classifying satellite images. Satellite image categorization algorithms are roughly divided into three categories: 1) automatic 2) manual and 3) hybrid. Satellite image classification requires the selection of an appropriate classification method depending on the criteria. This paper focuses on satellite image categorization methods and methodologies.

АННОТАЦИЯ Процедура классификации спутниковых изображений включает категоризацию значений пикселей изображения. Существует несколько подходов и процедур классификации спутниковых изображений. Алгоритмы категоризации спутниковых изображений условно делятся на три категории: 1) автоматические, 2) ручные и 3) гибридные. Классификация спутниковых изображений требует выбора подходящего метода классификации в зависимости от критериев. В данной статье основное внимание уделяется методам и методологиям категоризации спутниковых изображений.

ANNOTATSIYA Sun’iy yo‘ldosh tasvirini tasniflash tartibi tasvir piksellari qiymatlarini toifalarga ajratishni o‘z ichiga oladi. Sun’iy yo‘ldosh tasvirlarini tasniflashning bir qancha yondashuvlari va tartiblari mavjud. Sun’iy yo‘ldosh

tasvirlarini turkumlashtirish algoritmlari odatda uch toifaga bo‘linadi: 1) avtomatik 2) qo‘lda va 3) gibrid. Sun’iy yo‘ldosh tasvirini tasniflash mezonlarga qarab tegishli tasniflash usulini tanlashni talab qiladi. Ushbu tezisda sun’iy yo‘ldosh tasvirlarini tasniflash usullari va metodologiyalari o‘rganildi.

INTRODUCTION Satellite images are comprehensive and serve an important role in supplying geographical information [1]. Satellite and remote sensing photos give quantitative and qualitative information, reducing the complexity of fieldwork and study time [2]. Satellite remote sensing systems gather data and photos at regular intervals. The volume of data received at datacenters is massive, and it is increasing exponentially as technology advances at a rapid pace [3]. There is a critical need for effective and efficient procedures for extracting and interpreting meaningful information from large satellite photos. Satellite image classification is a strong approach for extracting information from large collections of satellite photos. Satellite image categorization is the process of organizing pixels into meaningful classes [4]. This is a multi-step process. Satellite image categorization is also known as extracting information from satellite images. Satellite image classification is simple, but the analyst must make numerous selections and choices during the process. Satellite image classification include interpreting remote sensing images, mining spatial data, researching various vegetation types such as farmland and foresters, as well as studying cities and determining diverse land uses in a given area [5]. This paper presents a brief literature overview on satellite image classification methods and approaches. It describes and explains several satellite image categorization methods to the analyst. This study is focused on automatic satellite image classification methods and methodologies. This paper aims to uncover the merits and limitations of each deep learning approach via thorough testing on benchmark datasets, providing insights into their applicability for various types of satellite image categorization tasks.

SATELLITE IMAGE TECHNIQUES

There are various approaches and procedures for classifying satellite images. Figure 1 depicts a hierarchy of satellite image classification algorithms. Satellite image classification methods are roughly divided into three categories:

- Automated
- Manual
- Hybrid

Automated. Automated satellite image categorization approaches employ algorithms that use the complete satellite image to arrange pixels into logical categories. The majority of classification methods come under this group. Figure 1 shows an example of satellite image classification. Automated satellite image classification algorithms are divided into two categories: 1) supervised 2) unsupervised classification algorithms. An analyst must provide input for supervised classification techniques. The analyst's input is referred to as the training set. The training sample is the most significant consideration in supervised satellite image classification algorithms. The accuracy of the approaches is strongly dependent on the training samples. There are two types of training samples: one for classification and another for assessing classification accuracy. Various classification strategies address different types of similarity matching procedures. Supervised classification offers extra features such as input data analysis, training sample and signature file creation, and quality determination.

Artificial Neural Network (ANN) algorithms replicate the human learning process by assigning appropriate meaningful labels to image pixels. The advantage of ANN-based satellite image classification algorithms is the ease with which supplementary data may be incorporated into the classification process, improving classification accuracy. Satellite image classification systems such as Binary Decision Tree (BDT) are examples of machine learning. The decision tree technique employs a set of binary rules that define meaningful classes to be assigned to individual pixels. Different decision tree software is available for generating binary rules. The software uses a training set and additional data to develop effective rules.

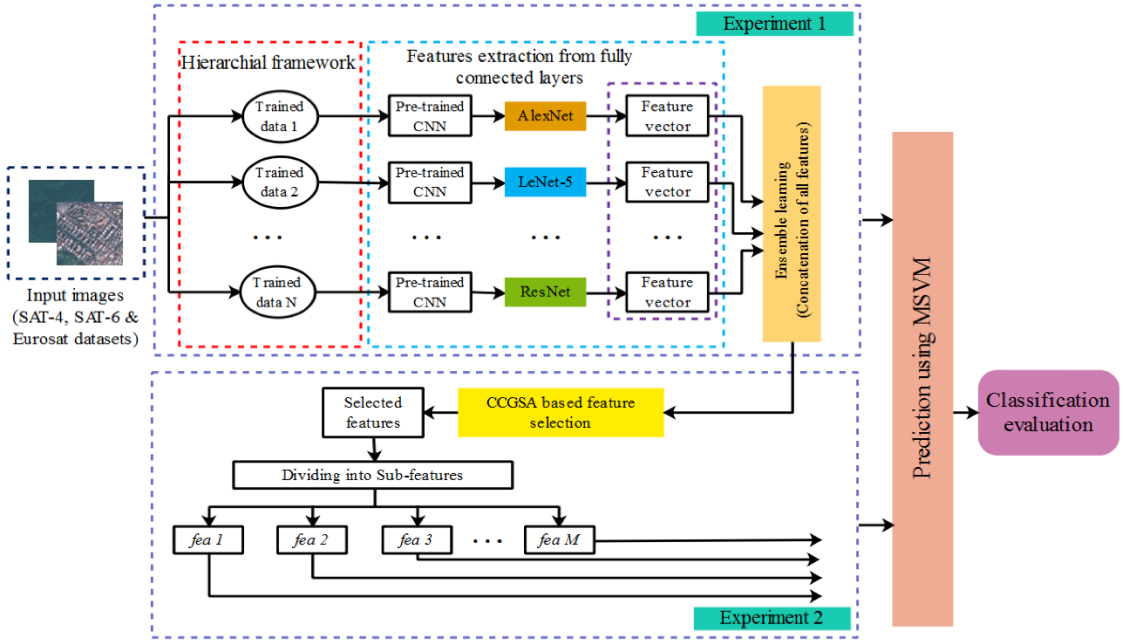

Figure 1. Satellite Image classification

Unsupervised classification employs clustering algorithms to divide satellite image pixels into unlabeled classes/clusters. Later, the analyst applies meaningful labels to the clusters, resulting in a well-classified satellite image. The most used unsupervised satellite image categorization algorithms are ISODATA, Support Vector Machine (SVM), and K-Means.

Manual. Manual satellite image classification methods are reliable, effective, and efficient. However, manual procedures consume more time. Manual approaches require the analyst to be familiar with the area covered by the satellite image. The efficiency and accuracy of classification depend on the analyst's knowledge and familiarity with the topic of research.

Hybrid. Hybrid satellite image categorization methods combine the benefits of automatic and manual approaches. The hybrid approach uses automated satellite image classification methods for initial classification, followed by manual approaches for refinement and error correction.

CONCLUSION

This study provides a summary of automated satellite image classification methods and contrasts multiple reviews conducted by different academics. Automated satellite image categorization systems can be divided into two categories: 1) supervised and 2) unsupervised. The methods used to arrange pixels into meaningful groups in supervised and unsupervised satellite image classification differ. In the

literature, researchers conducted a survey of satellite image classification algorithms and tested their effectiveness against various datasets. This study summarizes the numerous reviews of satellite image classification methods and approaches. The overview assists researchers in selecting the most relevant satellite image categorization method or approach based on their needs.

REFERENCES

[1] Muhammad, S., Aziz, G., Aneela, N. and Muhammad, S. 2012. "Classification by Object Recognition in SatelliteImages by using Data Mining". In Proc. Proceedings of the World Congress on Engineering (WCE 2012), Vol I, July 4 - 6, London, U.K.

[2] Chaichoke, V., Supawee, P., Tanasak, V. and Andrew, K, S. 2011. "A Normalized Difference Vegetation Index (NDVI) Time-Series of Idle Agriculture Lands: A Preliminary Study", Engineering Journal. Vol. 15, Issue 1, pp. 9-16.

[3] Zheng, X., Sun, X., Fu, K. and Hongqi Wang, 2013. "Automatic Annotation of Satellite Images via Multifeature Joint Sparse Coding With Spatial Relation Constraint", IEEE Geoscience and Remote Sensing Letters, VOL. 10, NO. 4, JULY 2013, pp.652-656.

[4] Anders Karlsson, 2003. "Classification of high resolution satellite images", August 2003, available at http://infoscience.epfl.ch/record/63248/files/TPD_Karlsson.pdf.

[5] Amanda Briney, 2014. "An Overview of Remote Sensing", May 16, 2014. [online] available at http://geography.about.com/od/geographictechnology/a/remotesensing.htm