ROUGH-SET-BASED COLOR CHANNEL SELECTION

* N SRIKANTH ***R RAMESH BABU
** MTech student, Dept of ECE, Jagruti Institute of Engineering and Technology, Hyderabad, TS, India.*
** Professor & HOD, Dept of ECE, Jagruti Institute of Engineering and Technology, Hyderabad, TS, India.*

Abstract - Color channel selection is essential for accurate segmentation of sky and clouds in images obtained from ground-based sky cameras. Most prior works in cloud segmentation use threshold-based methods on color channels selected in an ad hoc manner. In this letter, we propose the use of rough sets for color channel selection in visible-light images. Our proposed approach assesses color channels with respect to their contribution for segmentation and identifies the most effective ones.

Keywords: *Color, Sky camera, segmentation, Electroencephalography, asynchronous.*

I. INTRODUCTION

Classification of EEG signals is a crucial task in every brain-computer interface (BCI), allowing for accurate and low latency interaction between a disabled person and a computer application. Electroencephalography is a non-invasive method for monitoring of brain activity, whereas applying dedicated method of signal processing facilitates reasoning about mental condition, emotional state, as well as motion intents. Many reported experiments were aimed at recognition of so called imaginary motion, usually unilateral, i.e. of left or right hand. Such detection can be employed for paralysed or locked-in-state persons for steering motorized wheelchair computer applications. The classification of motion intent can be performed following two disjoint paradigms of synchronous and asynchronous systems. The former one involves flashing an icon on the screen in strictly timed intervals and verifying by means of the P300 potential if the person is focusing at this icon. Varying the flashing pattern for each icon is useful in applications with multiple choices. The latter approach allows for self-paced interaction, but it requires determining two states: non-control and control state, and then in the latter case classifying the type of control. The asynchronous approach is evaluated in this work, the method and results of classification of left and right, and up and down motion intents are assessed, and possibility for control of a multimedia applications is discussed.

II. RELATED STUDY

There are many important factors hampering signal acquisition and classifications in BCI applications. Published practical research is concerning the subject's mental fatigue often leading to low classification accuracy since the person is not able to concentrate on the task. Other aspects are electrodes positioning, skin conductance, hair thickness, which can be dealt with by hardware solutions such as: an electrode type, tight mounting cap, electrolytic gels, etc. On the other hand, a muscle electric activity of eye movements, blinks, heartbeat are present in the signal as artefacts, which they can be eliminated only employing signal processing methods. Our main contribution in this letter is to determine those color channels that are most discriminative in identifying cloud pixels in traditional visible-light images. We extend the benchmarking done in using a rough-set-based approach that can accurately assess the efficiency of different color channels for cloud segmentation.1 Rough set theory, originally introduced by Pawlak, is useful for representing uncertain data with a level of approximation and selecting the most discriminative features from the feature space. Recently, it has been successfully applied to hyper spectral band selection. To the best of our knowledge, our proposed approach is the first that uses rough set theory for color channel selection in visible-light images.

III. AN OVERVIEW OF PROPOSED SYSTEM

Ground-based whole sky imagers (WSIs) are becoming popular among the remote sensing community. They provide instantaneous data of cloud formations and are thus useful in a variety of applications. WSIs complement satellite images with localized data of higher temporal and spatial resolution. They capture images of the sky at regular intervals and archive them for processing. Most WSIs use traditional cameras in the visible-light spectrum, while a few models capture the near-infrared range as well. Typical post processing algorithms include the computation of the fraction of the sky covered by clouds, the recognition of cloud types, or the estimation of the cloud base height. A prerequisite for these applications is the segmentation of clouds from the sky, with each pixel of the image classified as either sky or cloud. As the sky is predominantly blue because of Rayleigh scattering, most existing approaches use thresholding on an ad hoc combination of red and blue color channels. Kreuter et al. used a fixed threshold for the blue/red ratio. Calbó and Sabburg use various statistical features (mean, standard deviation, entropy, etc.) obtained from red and blue channels for successful detection and subsequent labeling of pixels. The difference of red and blue channels is exploited. The saturation channel of the HSV color model is used. Recently, Li et al. proposed the use of a normalized red/blue ratio for cloud detection.

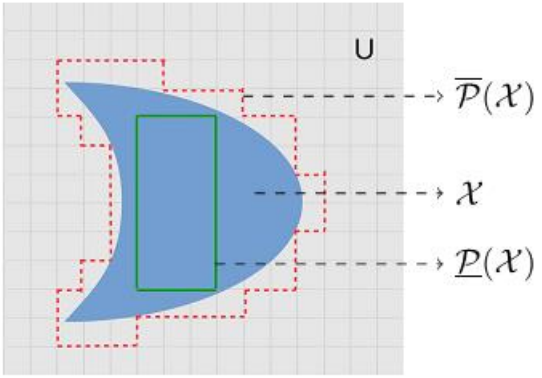

Fig.3.1.Proposed system model.

Fig. 1. Illustration of a typical rough set, which approximates a conventional set X (depicted in blue). Each individual grid depicts a partition of the universe generated by an equivalence relation. The union of all such partitions indicated with green solid borders (definite members) represents the lower approximation P(X), while the red dotted borders (possible members) represent the upper approximation P(X). In rough sets, information is expressed in the form of a decision table. We define a decision table L such that each row represents an observation and each column is an attribute from attribute set A. This nonempty set of observations is usually referred to as the universe U.

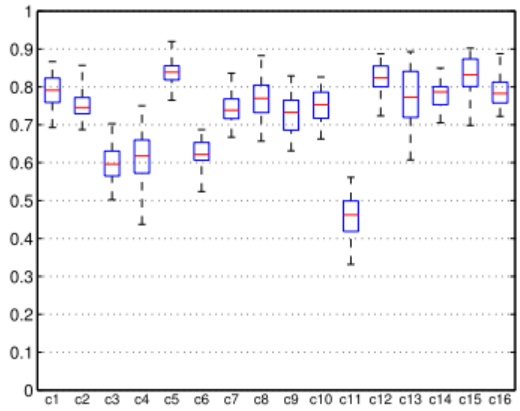

Fig.3.2. Output results.

IV. CONCLUSION

Sensing the earth's atmosphere using ground-based visible-light images is popular because of its low cost and the high temporal and spatial resolution of the captured images, compared with traditional satellite images. In this letter, we have proposed a color channel selection algorithm based on rough set theory. The experimental results show the efficacy of our approach in identifying favorable color channels for image segmentation. Our proposed approach outperforms other feature selection algorithms. Future work involves the extension of such rough-set-based approaches to other applications.

V. REFERENCES

[1]. S. Dev, B. Wen, Y. H. Lee, and S. Winkler, "Ground-based image analysis: A tutorial on machine-learning techniques and applications," IEEE Geosci. Remote Sens. Mag., vol. 4, no. 2, pp. 79–93, Jun. 2016.

[2]. S. Dev, F. M. Savoy, Y. H. Lee, and S. Winkler, "Design of low-cost, compact and weather-proof whole sky imagers for high-dynamic-range captures," in Proc. Int. Geosci. Remote Sens. Symp. (IGARSS), Jul. 2015, pp. 5359–5362.

[3]. E. Rumi, D. Kerr, J. M. Coupland, A. P. Sandford, and M. J. Brettle, "Automated cloud classification using a ground based infra-red camera and texture analysis techniques," Proc. SPIE, vol. 8890, Oct. 2013, Art. no. 88900J.

[4]. S. Dev, F. M. Savoy, Y. H. Lee, and S. Winkler, "WAHRSIS: A low-cost high-resolution whole sky imager with near-infrared capabilities," Proc. SPIE, vol. 9071, May 2014, Art. no. 90711L.

[5]. *Q. Li, W. Lu, J. Yang, and J. Z. Wang, "Thin cloud detection of all-sky images using Markov random fields," IEEE Geosci. Remote Sens. Lett., vol. 9, no. 3, pp. 417–421, May 2012.