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Band Analysis for Land Use in Multi Spectral Images

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ABSTRACT
Hyper spectral and multi spectral image analysis is the commonly used technique for land use and land cover classification. Effective use of the land cover can play a vital role in the development of country. Multi spectral satellites use passive sensor, hence the only source of energy involved in the acquisition of satellite imagery is the reflectance of the sun. In order to investigate the role of individual bands of the Visible and infra-red region in the recognition of land covers such as vegetation, non-vegetation, settlements and barren land an extensive research has been carried out.

This paper is focused in the dissection and contribution of individual component (band) of SPOT-5 imagery for land cover analysis as well. In this article extensive experimentation has been carried out which reveals the effect of individual and combine bands in the recognition of land cover. Classifications of various bands were done using supervised machine learning classification, random forest classifier has been used for classification purpose.

Keywords
Land cover classification, SPOT-5, multi-spectral imagery, random forest, NIR, SWIR.

1. INTRODUCTION
In remote sensing analysis, the primary source of obtaining the imagery is satellite. The sensors in the satellite are responsible for the conversion of sunlight energy into pixels. Based on the sensor features sensors are either multi spectral or hyper spectral. Multi spectral sensors has multiple bands while hyper spectral has more than hundred bands and are thus hyper spectral sensors are more powerful from multispectral with the capability of storing more information regarding the geography of a surface.

To make use of the satellite imagery commonly machine learning techniques are used. Common approaches followed are pixel and object based classification of the imagery. In object based classification approach, the given image is divided into small object called patches, based on patches training set is created for classifier learning while in pixel based approach the underlying pixels of the image is considered as features, these features are processed for the detection of area of interest. Various methods has been adopted for the classification of land covers, in literature the state of art classifier used for land cover analysis, change detection and land use analysis are SVM, ANN, MLE and Random forest. Maximum likelihood classifier is from the parametric set of classifiers which use the prior information about the event. Based on these prior probabilities the probability of an event for all the classes are calculated, the most probable class for the event is the one having the maximum probability. The performance of maximum likelihood compared with the distance based classifier such as Minimum distance and Mahalanobis distance, which showed that maximum likelihood has the high recognition compared to the other classifiers, the comparison was carried out on raw Landsat thematic Mapper imagery having resolution of 90m [1]. For pixel based classification such as change analysis, land cover classification is mostly suited [3-6]. The strength of MLE has also been investigated in the use of thematic data [2]. MLE uses the probability distribution based on which the incoming pixel is classified and hence this technique fails to discriminate between pixels having the same spectral signatures compared to non-parametric classifier such as ANN [7]. A neural network consists of input, output and hidden layer. The input layer of the neural network consist of raw data which is presented in the form of vectors, the hidden layer contains the kernels or activation function which maps the input to the output layer. The strength of ANN has influenced the process of classification of both hyper spectral and multi-spectral satellite imagery compared to other parametric approaches [8-12]. Beside ANN and MLE SVM is also used for land cover classification. On low resolution satellite imagery SVM has outperformed MLE and ANN [13]. SVM crates an optimal decision boundary for the classes, originally the SVM were used for binary classification. Today SVM has various nonlinear kernels such as Basis function (RBF), Polynomial and sigmoid [14]. For pixel based classification of satellite imagery parametric and non-parametric classifier has been used [15]. Based SVM and ANN, Random forest is also used for land cover analysis in the recent studies [18]. A random forest is a tree based classifier or more specifically random forest is an ensemble classifier which combines more than one tree using bootstrapping and bagging approaches to make a random forest. More detail about random forest can be found in [17]. The comparison between parametric random forest and non-parametric MLE shows that random forest has the high accuracy on high resolution imagery [18]. The random forest based approach has also been applied to the high resolution Landsat Imagery and has shown better results [19]. For agricultural change detection the use of Normalized difference vegetation Index (NDVI) has been advocated. NDVI uses vegetation indexes which are helpful in determining the change in the agriculture. In [16], the author has demonstrated the role of vegetation indexes to locate the land use and land cover changes over a period of time.

In this paper, we have illustrated the role of individual band of the multi-spectral satellite imagery on land use classification detection and classification. The experimentation setup was carried out on SPOT-5 satellite imagery which consist of Four bands namely Green, Red, Near infra-red and Short Wave Infra-red. The high resolution dataset were classifier using 10

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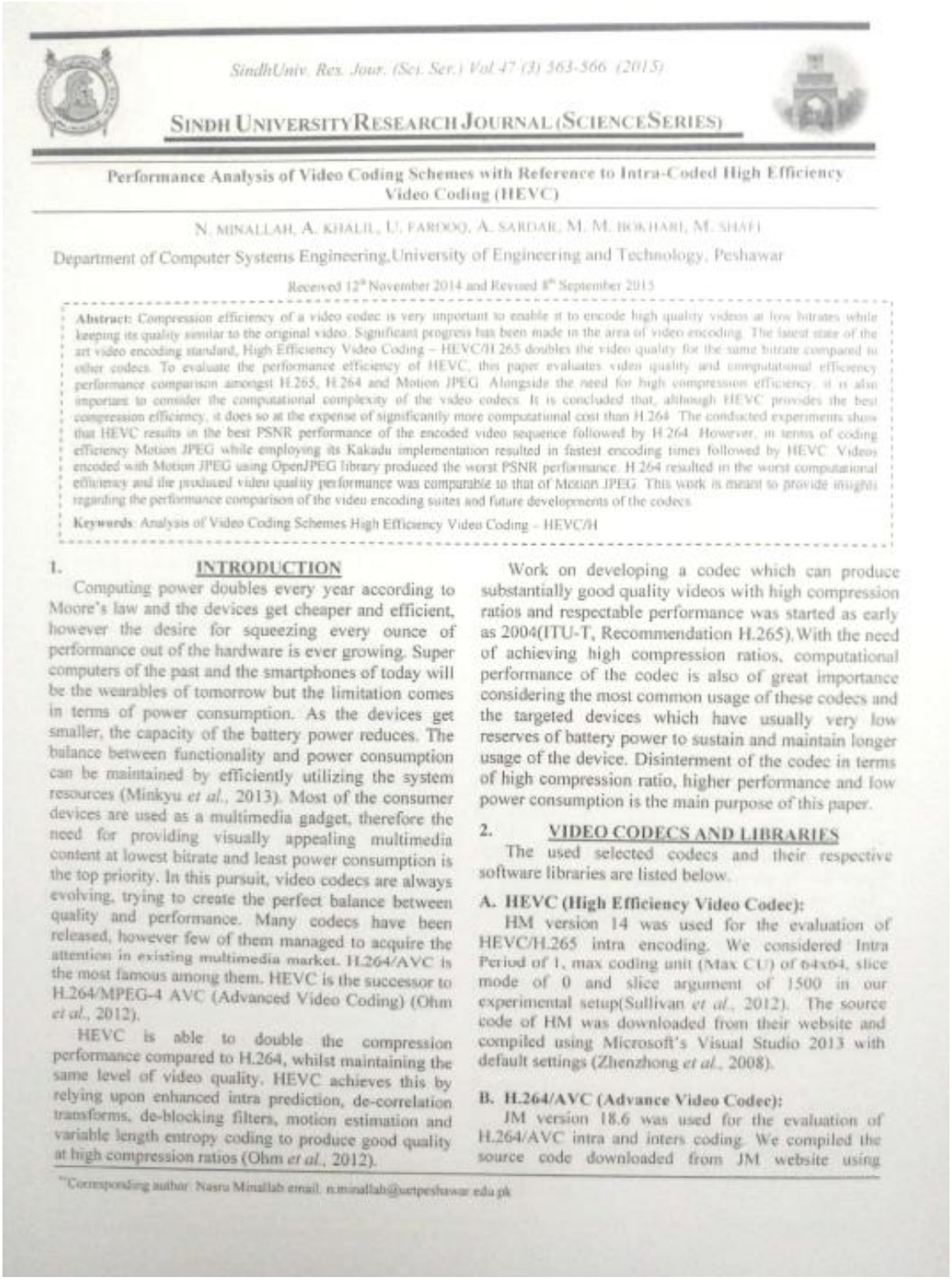

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Performance Analysis of Video Coding Schemes with Reference to Intra-Coded High Efficiency Video Coding (HEVC)

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Abstract: Compression efficiency of a video codec is very important to enable it to encode high quality videos at low bitrates while keeping its quality similar to the original video. Significant progress has been made in the area of video encoding. The latest state of the art video encoding standard, High Efficiency Video Coding – HEVC/H.265 doubles the video quality for the same bitrate compared to other codecs. To evaluate the performance efficiency of HEVC, this paper evaluates video quality and computational efficiency performance comparison amongst H.265, H.264 and Motion JPEG. Alongside the need for high compression efficiency, it is also important to consider the computational complexity of the video codecs. It is concluded that, although HEVC provides the best compression efficiency, it does so at the expense of significantly more computational cost than H.264. The conducted experiments show that HEVC results in the best PSNR performance of the encoded video sequence followed by H.264. However, in terms of coding efficiency Motion JPEG while employing its Kakadu implementation resulted in fastest encoding times followed by HEVC. Videos encoded with Motion JPEG using OpenJPEG library produced the worst PSNR performance. H.264 resulted in the worst computational efficiency and the produced video quality performance was comparable to that of Motion JPEG. This work is meant to provide insights regarding the performance comparison of the video encoding suites and future developments of the codecs.

Keywords: Analysis of Video Coding Schemes High Efficiency Video Coding – HEVC/H

1. INTRODUCTION

Computing power doubles every year according to Moore's law and the devices get cheaper and efficient, however the desire for squeezing every ounce of performance out of the hardware is ever growing. Super computers of the past and the smartphones of today will be the wearables of tomorrow but the limitation comes in terms of power consumption. As the devices get smaller, the capacity of the battery power reduces. The balance between functionality and power consumption can be maintained by efficiently utilizing the system resources (Minkyu *et al.*, 2013). Most of the consumer devices are used as a multimedia gadget, therefore the need for providing visually appealing multimedia content at lowest bitrate and least power consumption is the top priority. In this pursuit, video codecs are always evolving, trying to create the perfect balance between quality and performance. Many codecs have been released, however few of them managed to acquire the attention in existing multimedia market. H.264/AVC is the most famous among them. HEVC is the successor to H.264/MPEG-4 AVC (Advanced Video Coding) (Ohm *et al.*, 2012).

HEVC is able to double the compression performance compared to H.264, whilst maintaining the same level of video quality. HEVC achieves this by relying upon enhanced intra prediction, de-correlation transforms, de-blocking filters, motion estimation and variable length entropy coding to produce good quality at high compression ratios (Ohm *et al.*, 2012).

Work on developing a codec which can produce substantially good quality videos with high compression ratios and respectable performance was started as early as 2004(ITU-T, Recommendation H.265). With the need of achieving high compression ratios, computational performance of the codec is also of great importance considering the most common usage of these codecs and the targeted devices which have usually very low reserves of battery power to sustain and maintain longer usage of the device. Disinterment of the codec in terms of high compression ratio, higher performance and low power consumption is the main purpose of this paper.

2. VIDEO CODECS AND LIBRARIES

The used selected codecs and their respective software libraries are listed below.

A. HEVC (High Efficiency Video Codec):

HM version 14 was used for the evaluation of HEVC/H.265 intra encoding. We considered Intra Period of 1, max coding unit (Max CU) of 64x64, slice mode of 0 and slice argument of 1500 in our experimental setup(Sullivan *et al.*, 2012). The source code of HM was downloaded from their website and compiled using Microsoft's Visual Studio 2013 with default settings (Zhenzhong *et al.*, 2008).

B. H.264/AVC (Advance Video Codec):

JM version 18.6 was used for the evaluation of H.264/AVC intra and inters coding. We compiled the source code downloaded from JM website using

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Performance Analysis of Image Compression Standards with Reference to JPEG 2000

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Abstract: JPEG 2000 is the most widely used standard for still image coding. Some other well-known image coding techniques include JPEG, JPEG XR and WEBP. This paper provides performance evaluation of JPEG 2000 with reference to other image coding standards, such as JPEG, JPEG XR and WEBP. For the performance evaluation of JPEG 2000 with reference to JPEG, JPEG XR and WebP, we considered divers image coding scenarios such as continuous tone images, grey scale images, High Definition (HD) images, true color images and web images. Each of the considered algorithms are briefly explained followed by their performance evaluations using different quality metrics, such as Peak Signal to Noise Ratio (PSNR), Mean Square Error (MSE), Structure Similarity Index (SSIM), Bits Per Pixel (BPP), Compression Ratio (CR) and Encoding/ Decoding Complexity. The results obtained showed that choice of the each algorithm depends upon the imaging scenario and it was found that JPEG 2000 supports the widest set of features among the evaluated standards and better performance.

Keywords: Analysis, Standards JPEG 2000.

1. INTRODUCTION

There are different standards of image compression and decompression. Four of the very famous and widely used image compression standards include Joint Photographic Expert Group (JPEG), JPEG-XR (Extended Range), JPEG 2000 and WebP (Dufaux, *et al.* 2009). These standards have high compression performances and are widely used for images storage and transmission over wired and wireless networks. The comparison parameters used for performance evaluation are Structural Similarity Index (SSIM) (Yusra, *et al.* 2012), Bit per Pixel (BPP), Peak Signal to Noise Ratio (PSNR) (Ziguan, *et al.* 2014), Mean Square Error (MSE) (Ziguan, *et al.* 2014), Compression Ratio (Koli, *et al.* 2006) and Complexity (Shnayderman, *et al.* 2006)

In our experimental setup, we have used five set of images, each set with 10 images. These images are taken from various sources and are widely used in the streaming and storage scenarios. These images are encoded using different compression ratios and their encoding time is calculated. Furthermore, the performance of the encoding technique is evaluated using different quality evaluation metrics such as PSNR, SSIM, BPP, Compression Ratio and Complexity. This paper is organized as follows. Section 2 provides an overview of the considered encoding algorithms. In Section 3 we explain the test set that we used during our analysis. Section 4 explains our methodology that we employed for the performance evaluation of the considered coding schemes. Section 5 explains the system configuration setup for the performance analysis, followed by Section 6 with explanation of the considered performance analysis factors. Section 7 provides the results and discussions about the obtained performance. Finally the conclusion of the paper is provided in section 8.

2. OVERVIEW OF COMPRESSION ALGORITHMS

For our performance analysis study of the image encoding algorithms, we compared the performance of the most widely used compression algorithm –i.e. JPEG 2000 with the JPEG (basic algorithm mostly used in digital cameras), WEBP (commonly used on web) and JPEG XR (extended version of JPEG).

2.1 JPEG

This is well known standard developed in 1980's.The file name extensions for JPEG are .jpe, .jpeg and .jpg. JPEG is one of the image compression technique commonly used for lossy compression in digital images. It allows a trade-off between storage size and image quality (Tung Nguyen, *et al.* 2012)

2.2 JPEG-2000

JPEG 2000 is a continuation of JPEG standard. It was made standardized in year 2000. The reason behind its standardization was in order to super seed the JPEG Discrete Cosine Transform based version over Discrete Wavelet Transform. The filename extension is .JP2. JPEG 2000 has a unique feature of region of interest coding as well as it offers several mechanisms for spatial random access and region of interest access at varying degree of granularity (Dufaux, *et al.* 2009).

2.3 JPEG-XR

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Mining Social Media photos to Measure Point-of-Interest Connectivity

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Abstract-The capability of social media to allow users to upload their geo-tagged and text tagged photos has led to the creation of a voluminous data, which can be mined to extract useful information. Most of these photos are public and can be accessed and analyzed for extracting useful patterns. This paper presents a prediction of Point of Interest (POI) connectivity through mining these publically available photos on social media. Two POI are considered connected for a particular user, if the user has taken photos of the two points, within certain duration of time. The proposed research can be utilized in (1) building a recommender system that would help the tourists planning their travel sequence and (2) helping the tourism management authorities to predict the tourism statistics of the nearby POI once they have collected statistics of a particular POI. This information can be utilized in efficient resource management for sustainable tourism.

Keywords: Social Media, Mining, Region-of-interest, Geo-tagged, Tourism

1. INTRODUCTION

Most social media applications offer photo-uploading services to users. The users can tag their photos public or private. It has been observed that most of the photos related to points of interest are kept public and hence they could easily be accessed through the Application Programmer Interfaces (APIs). These photos can be analyzed to extract useful information. This paper presents a framework for extracting the POI connectivity through mining these publically available social media photos. Such a framework could be utilized in various ways for tourism improvement such as (1) building an intelligent recommender system for tourists by combining the proposed work with some Artificial Intelligence planning techniques (Sirin, *et al.* 2004; Saleem, *et al.* 2013) and (2) helping the tourism management authorities to predict the tourism statistics of the nearby POI once they have collected statistics of a particular POI which will help in efficient resource management for sustainable tourism.

Tourism is usually performed in new and unfamiliar requirements. In such situations, it is a promising idea to inform the tourists about the interest level they might have in a certain location. A visitor might like or dislike to visit two points together, based on the distance between them, travel time, hurdles and traffic conditions, nature (whether the two points are related or not) and various other parameters. While distance between the two points is easily available, the rest of the parameters are not easily available for most of the places. Hence there is a need for an automated system that could suggest a connectivity-measurement (which could potentially be a combination of all these parameters) of the two points to the tourist. This paper analyzes the publically available photos on Flicker (http://www.flickr.com/services/api/) to find the connectivity between two points. The basic principle for connectivity measurement is straightforward: if a user has taken a photo of point A, and has also taken a photo of point B at the same time or same day; we assume that he has visited both points at the same day.

The rest of the paper is organized as follow: Section 2 states the related work from literature, Section 3 gives an overview of Flickr (an image tagging website) APIs, Section 4 explains the structure of the database for storing different parameters of the photos, Section 5 details the connectivity measurement algorithm, Section 6 presents a case study and Section 7 concludes the paper with future directions.

2. RELATED WORK

Zheng *et al.* have carried out a comprehensive literature survey on the utilization of geo-tagged multimedia (Zheng, *et al.* 2011). They have categorized the geo-tagged multimedia utilization research into four broad categories: organization and summarization of photos (Smith 1996; Camara and Raper 1999; Jung 1999; Lim, *et al.* 2002; Toyama, *et al.* 2003; Naaman, *et al.* 2004; Pigeau and Gelgon 2004; Jaffe, *et al.* 2006; Heuer and Dupke 2007), mining knowledge from geo-tagged multimedia (Jaffe, *et al.* 2006; Kennedy, *et al.* 2007; Hile, *et al.* 2008), learning landmarks (Kennedy and Naaman 2008; Abbasi, Chernov *et al.* 2009), and geographic location estimation from photos (Hays and Efros 2008). The proposed work falls in the category of knowledge mining from geo-tagged data. Following is an overview of some of the closely related existing work.

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Towards an Efficient Urdu Keyboard Layout

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Abstract- English is the most common language for conveying digital information in the world. However, there is a huge population of world that doesn't understand English and hence there is a need of translating the digital information to other languages as well. Translation of Information Communication Technologies (ICTs') to local languages has been a focus of the research for quite a while now. Keyboard has been one of the main sources of input in ICTs' and like translation of information, there is a need of Keyboard localization (efficient customization of keyboard for other languages). This paper presents efficient keyboard localization of Urdu language. This paper proposes four techniques adopted from Dvorak to analyze Urdu words based on alphabet frequencies to design an efficient Urdu keyboard layout. These techniques are frequency words, Letter Frequencies, Diagraphs frequencies and reverse diagraph frequencies. Five thousand most frequently used words of Urdu were analyzed by these four techniques and it was concluded that layouts resulting from this analyses would be different from the most commonly used Urdu phonetic keyboard. Therefore there is need to consider these layouts as well to design an efficient keyboard layout for Urdu users.

Keywords: Unicode, Localization, Diagraph, Urdu, Keyboard, Layout

1. INTRODUCTION

Access of information is considered as a basic human right. Internet is one of the major sources of information in the modern world. Most of the information on the internet is available in English, being the widely spoken language in the World. However, there is still a huge population that can't use this information as it is incapable of reading and writing in English (Hussain, *et al.*,2004). For example in Pakistan, only 5-10% of the entire population understands English of which only 1.2 % use internet (Hussain, *et al.*,2004). Hence there is a need of transforming this information into other local languages as well. This process of transformation of ICTs' into local languages is known as localization. Local language computing standards (e.g. keyboard (and keypad) layout, character set encoding, sorting/collation sequence, locale and ICT terminology (Hussain, *et al.*, 2004)) must be followed during this localization process.

Urdu, apart from being the national language of Pakistan, is the first language of more than 60 million people and spoken by more than 100 million people across various countries of the world (Anon., 2013). Use of Urdu in computation started in 1980s but no standard encoding scheme was present at that time. Multiple encoding schemes therefore were introduced by various vendors for the localization of Urdu later on (Hussain, 2008). One of them is Urdu Zabta Takhti UZT 1.01 which is 8-bit encoding standard accepted in 2000 by the Government of Pakistan (Hussain, *et al.*,2004). After inception of UNICODE in early 1990s, some online Urdu publications have started using Unicode (Hussain, 2008). Unicode 4.0 completely supports Urdu language (Hussain, *et al.*, 2004). However, the display of text is only a one dimension in ICTs' whereas other dimensions include writing as well. The basic device for such input is Keyboard.

Keyboard layout design is an integral part of local language computing standards (Hussain, *et al.*,2004). The QWERTY keyboard has been used as a primary input method for a long time though it is being considered as a less efficient, incorrect standard and poor arrangement for touch typing by many experts (Matias, *et al.*,1996). The QWERTY keyboard layout was invented in 1868 and was designed to separate most frequently occurring letter pairs to get rid of mechanical clashes caused during fast typing (Jasmin & Casasanto, 2012). The factor of ease in typing or learning was not considered during its design (Norman and Fisher, 1981). The letter placements are not ideal which causes fatigue, errors and lower typing speed. Also, the typing speed and comfort of user is greatly influenced by the arrangement of letters on the keyboard (Wagner, *et al.*, 2003). Research work has been carried out to overcome these issues. One of the most significant attempts was made by Dvorak *et al.*,whose dominant theme was maximum efficiency (Parkinson, 2000). Dovrak arranged keyboard layout on scientific principles. He assigned 30 characters in three rows out of which 26 are letters and 4 are punctuation marks.

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ON THE PERFORMANCE OF SUPERVISED CLASSIFIERS FOR CROP IDENTIFICATION AND ESTIMATION USING MULTI-SPECTRAL IMAGERY

Asif Ali Khan*, Nasru Minallah*, Shahbaz Khan**

ABSTRACT

The objective of this research is to investigate crop estimation using SPOT-5 satellite imagery. We specifically considered tobacco as our pilot crop and compared the obtained results with manually delineated calculations. For this research SPOT-5 imagery of 2.5m spatial resolution, was provided by Space and Upper Atmosphere Research Commission (SUPARCO), space agency of Pakistan. After preprocessing, which is a preparatory step in analyzing and classifying satellite imagery to improve classification results and reduce the efforts and processing time, different supervised classifiers namely Maximum Likelihood approach, Neural Network and Minimum Distance Classifier have been used to classify the imagery. Training data for classifiers has been collected through multiple field surveys using GPS receivers. The results obtained clearly show that the performance of maximum-likelihood classifier is better than the other considered counterparts. Also it is indicated that the newly developed system offer an efficient, reliable and faster approach for estimation of tobacco crop.

KEY WORDS: *Crop Estimation, SPOT-5 imagery, Maximum Likelihood classifier, Neural Network, Region of Interest (ROI), Minimum Distance Classifier*

INTRODUCTION

Pakistan is the 7th largest tobacco growing country in the world[1]. Pakistan Tobacco Board (PTB), a government organization is regulating tobacco crop growing in Pakistan. The PTB play an important role to measure and estimate the total yield of tobacco. This yield measurement and estimation of tobacco crop is very important for government agencies and tobacco regulatory authorities to strictly monitor the tobacco production and to keep its production within allowed limits. Furthermore it also helps in tracking proper tax collection on the basis of tobacco crop yield.

Conventional strategies based on manual measurements are currently used within Pakistan to estimate the overall tobacco yield which is not only time consuming but also prone to human errors. Furthermore, controlled monitoring of tobacco crop within remote villages of Pakistan is only possible through remote sensing because uncooperative attitude of the rural community to limit tobacco production and to deposit Tax returns on Tobacco yield is a major limitation in precise yield data collection using manual measurements.

In this paper, we investigate the application of remote sensing for crop identification and estimation using different approaches such as Maximum Likelihood classification, Neural Network and Minimum Distance Classifier.

Since the development of remote sensing systems, its use is highly considered by both the research and development community for agricultural purposes. Data derived from these systems has been used for crop mapping, crop type identification and crop area estimation. Crop productivity i.e. its type and spatial area coverage is the most important factor for accurate crop yield estimation.

General classification and image processing techniques are used for mapping and identification of crop areas from multi temporal satellite imagery. Different segmentation algorithms are applied on the imagery for object based classification. Several classification techniques such as maximum likelihood approach, Support Vector Machine (SVM), minimum distance and nearest neighbor classifiers etc. are used for identifying different objects.

Satellite imagery has been used for different purposes in agriculture. The urban vegetation has been calculated using different satellite images[2]. The objective of the research was to investigate and calculate the natural resources and vegetation in settled areas using different satellite images. Johnsan et al[3], used Spot-5 imagery to map banana plantation using object-oriented approach. Harris[4] used Landsat imagery for identifying agricultural

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