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Optimum Torque - Zero d-axis Current Control of Direct Driven PMSG Based Wind Energy Conversion System

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***Abstract*—For power conversion in wind energy conversion systems, fast and smooth performance is essential. Here, a control system in which optimum torque control and zero d-axis current control is combined for better performance of machine side converter in terms of maximum power point tracking. Using the control discussed, the wind energy conversion system is able to extract maximum available power from wind at varying wind speeds.The synchronous reference frame theory based control is applied to grid side converter for DC-link voltage control and better grid synchronization. As a whole, the explained control system for direct driven PMSG based WECS provides better performance in machine side and grid side, at varying wind speed conditions.**

***Index Terms*—maximum power point tracking, optimum torque control, zero d-axis current control, synchronous reference frame theory.**

I. Introduction

Environmental crisis such as global warming, and climate change, and high oil prices caused by reduced availability of fossil fuel, are the main reasons behind the fast development of renewable energy. Wind energy is an important renewable energy which is absolutely free and clean. Thus, wind energy conversion system plays a vital role in the present energy context. PMSG based wind energy conversion system have several advantages such as, they do not require additional DC supply for excitation circuit, simpler and need less maintenance because of absence of slip rings, higher power coefficient and efficiency, and are more stable and secure during normal operation when compared to WECS with DFIG and SCIG. Field oriented control (FOC) is the most commonly used and simple control technique used for successful operation of WECS. Because of the non unique nature of optimum power constant, FOC can not give exact point for optimum power. In [1], two methods of tracking of optimum power point are proposed, where fast settling occurs as tracking is got faster. Direct Torque Control (DTC) is another most used control technique [2]. But it has torque and flux ripples associated with. This can be minimised by increasing number of voltage vectors. But this method is not suitable for reducing current ripples. In [3] a mixed sensitivity Hα controller for controlling active and reactive power, and reducing current ripples is discussed. But this is not suitable for varying wind speed cases, as it doesn't involve external disturbance variation in design stage.Later, sliding mode control based FOC has arrived but it was affected by limitations such as chattering and slow response [4]. Then, Reduced order Extended Kalman Filter (REKF) was introduced, in which position sensor noise of permanent magnet machine has greatly reduced. But the computational tasks involved in it was too complex. The real time implementation of this control was difficult [5]. The limitations so far was greatly reduced by using active disturbance rejection control (ADRC) where extended state observer (ESO) was introduced to reduce the too much dependency on mathematical model[6]. By considering coupling effect as a mode uncertainty, the independent control of a coupled system is possible by this method. Single loop ADRC has handled the wind speed variation successfully. Later [7] introduced multi loop ADRC to handle parameter variation in stator resistance and inductance also.

Here, a direct driven PMSG based WECS with Optimum Torque Control - Zero d-axis Current (OTC-ZDC) control as machine side converter control and Synchronous Reference Frame (SRF) control as grid side converter control is simulated and the performance of the system is studied for varying wind speed as external disturbance.

The rest of the paper is organized as follows.The methodology of WECS including detailed discription of MPPT, MSC Control and GSC control is discussed in section II. The performance analysis of WECS with simulation results are discussed in section III. Section IV provides the conclusion of the paper.

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Review On Brain Tumor Malignancy Prediction By 3D Reconstruction

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***Abstract*—A major increase in brain tumor has been seen in recent years, and it is in the tenth position. It is sever type of cancer and influences in people of all ages. Hence, if diagnosed well at the initial stage, it will turn out to be one of the most curable types of tumors. The computer aided analysis of MRI is performed to diagnosis the tumor through the process of classifying and segmenting. From the previous years of study, the research areas are mainly concentrated on machine and deep learning for brain malignancy prediction and treatment. The two dimensional MRI images helps to detect and classify the brain cancer precisely and efficiently. Usually the MRI images are two dimensional and not give sufficient knowledge regarding the structure and exact size of the tumor can be removed, and the detection procedure has become more complex. Since two-dimensional images never offer the actual feeling of exactly how a tumor looks, diagnosis includes 3D tumor reconstruction, planning for surgery and biological studies. The survival rate shows gives us an exact picture of the number of patients who have survived after the tumor is identified. The 5-year and 10 year survival rate is approximately 36 percent and 31 percent respectively for persons with a cancerous brain or CNS tumor. For increasing the survival rate of brain tumor, 3D image reconstruction can be used and it is one of the best attractive features in virtual reality, especially because of its application in medical image processing.**

Keywords*— *Brain cancer, MRI, Machine Learning, Deep Learning

I. INTRODUCTION

Tumors in brain contain many abnormally developing tissues which have come from uncontrolled proliferation of cells, and inside the brain the physio-logical characteristic of this tissue cannot be found. Besides the increase in brain size and the swelling due to tumor are responsible for the cause of neurological symptoms that are irregular. Primary and secondary brain tumors are the two classes of brain cancers. Tumors that start in brain itself are known as primary brain cancer. A metastatic or secondary brain tumor starts from lung, breast, colon or skin and then gradually moves on to the brain and it is highly severe and life threatening.

The WHO has classified the tumor onto 120 classifications depend on the kind and location of the tumor cell, creates many complication in diagnosis process. Based on the occurrence of cells a name is given to tumors and they are numbered ranging from I-IV. This number is known as the grade and it shows the vast expansion of cells and its spread. This is an important knowledge for care planning and outcome prediction.

from multiple angles, a scan shows computerized representations of the brain and spinal cord and it helps the doctor to identify the difference between cancerous and non-cancerous tissue. MRI can produce transparent and accurate pictures of a brain cancer in three dimensions.

MR images are familiar types of imaging techniques for non-invasive in tumor research. A collection of cross-sectional images of the brain is obtained by MRI. That is, a series of 2D parallel cross-sectional images can be viewed as anatomical descriptions of the 3D tumor. The reconstruction of 3D images in the form of 2D projected slices results in information loss and incorrect interpretation. 2D images do not reliably portray the nuances of human anatomy and it is often difficult for radiologist to express their interpretations to a doctor who may have trouble imagining the 3D anatomy. Therefore, from a series of 2D parallel cross sectional images of the tumor, there is a need for 3D tumor reconstruction. 3D visualization provides a clearer understanding of the tumor's topology and form, and allows its geometrical characteristics to be calculated. The data extracted is useful in tumor staging, surgical preparation, and biological research. Therefore, in biomedical 3D visualization, how to recreate a trustworthy surface from the sequential parallel 2D cross sections becomes a crucial question.

The structures of this review paper as given below: the second session gives details of the brain cancer, grade classification. In third session discusses about how the MRI image analysis. The main concepts of machine learning techniques are explained in section 4. The fifth section provides a literature review of two dimensional MRI analyses for detecting the brain tumors. Section 6 provides a review of three dimensional reconstructions of MRI images and its analysis. Section 7 gives an overall summary of this study.

II. BACKGROUND STUDY OF BRAIN TUMOR AND ITS GRADE CLASSIFICATION

In human body the new cells starts growing when the regular cells grow old or get hurt. Sometimes the human body doesn't need new cells but still the new cells are formed without damage of the old cells. This result in accumulation of a large cell called a growth or tumor.

Brain cancers consist of group of irregular cells accumulates in the brain. The Skull, which covers the brain, is very hard and it may cause complications with any development inside this restricted location. The development of these tumors within the brain results in the increase of

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Preliminary Prototype and Analysis of a Customized Handle for Winding Machine using Fused Filament Fabrication

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Abstract – Additive manufacturing transformed the prospect of product development. Customized and individualized product development never be so effortless. In this context, aim here is to develop a preliminary prototype of customized handle for winding machine using in handloom industry. Design of the handle is completed according to the hand anthropometric data of workers. CATIA V5R20 is used for 3D modeling and Analysis. Polylactic Acid (PLA) used as material and FlashForge Dreamer Additive Manufacturing (AM) machine, which works based Fused Filament Fabrication (FFF) is employed for prototyping. Analysis confirms that the design using PLA material is safe as maximum von Moses stress obtained (6.57 x 10^4 N/m²) is less than the yield strength of PLA material (4.9 x 10^7 N/m²).

Keywords – Prototype; Customization; Fused Filament Fabrication, Handle, Hand Anthropometry, Additive Manufacturing.

Introduction

By eliminating tool and reducing wastage of material, Additive Manufacturing (AM) or 3D Printing (3DP) can be considered as one of the most noteworthy development in manufacturing in recent years, which directly prints from Computer Aided Design (CAD) data layer – by – layer [1]. It helps the technology to be a potential player in Industry 4.0 [2]. Fused Filament Fabrication (FFF) or Fused Deposition Modeling (FDM) is an AM technology which usually fabricate the objects layer-by-layer by extruding material through a nozzle [3, 4]. FFF parts can be used in wide variety of applications from unarmed aerial vehicles to 3D Printers [5].

Parry et al. developed a customized crutch grip using 3D scanner, Autodesk Fusion 360, and Stereolithography (SLA) additive manufacturing and recommended that AM is a worthwhile method for fabricating customized Daily Living Aids (DLA) [6]. Additionally, using reverse engineering and FDM additive manufacturing technology, a customized helmet is developed with enhanced comfort. The researchers concluded from the study that the method is suitable for rapid product development and to address the needs of the customer individually [7].

A customized hand orthosis is developed using 3D Scanner and FDM AM machine with a printing time of about 11 hours and lead time of about 1 day, which will be useful for patients [8]. In addition to this, individually customized wrist orthosis was designed using the 3D scanned data of a patient and fabricated by employing FDM technology with upper layer of the orthosis was made of ABS and inner layer was made using TPU (Thermoplastic Polyurethane) [9]. TPU has considerable elasticity and research proved that the flexible inner layer increases the comfort of user [9].

Furthermore, customized orthosis is fabricated using Autodesk Inventor 3D modeling software, 3D scanner, MeshLab software for creating an automated algorithm of 3D scan data, and Raise 3D Pro FDM AM machine [10]. The study concluded that Polylactic Acid (PLA) is strong when compared to other materials used such as Acrylonitrile Butadiene Styrene (ABS), High impact Polystyrene (HIPS), and Polyamide 12 (PA12 – nylon) [10]. Fabrication of customized prosthetic sockets for upper limbs using 3D scanner and FDM process proved the feasibility of fully functional products [11].

Textile industries facing a challenge to deliver more customized products and amalgamation of product, process, and supply chain designs is the feasible to achieve customization in textile industry [12, 13]. At the same time, Chatterjee and Ghosh believed that textile industry can utilize 3DP by exploring its unique capability of manufacturing customized products [14].

From above it can be understood that the research explored the possibility of customized products in various areas including textile

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Text Detection and Script Identification from Images using CNN.

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Abstract: For humans, text is one of the most significant sources of knowledge. Detection of text in images has been an interesting computer vision topic in both industrial and academic study. There has been a lot of effort made into improving existing methods and establishing new ones. Sliding windows and connected component systems are more classic solutions. In this paper we are discussing some text detection methods. In this paper we are discussing text detection and identification based on convolutional neural network. Script identification is done by integrating local area and global area.

I. Introduction

People who travel to different places find it difficult to communicate with locals because they do not speak the language. They can't understand what is written on any board or banner. As a result, text information extraction systems that can identify, recognise, and translate text contained in images are required. The text in images is extracted using this system. Following the text extraction method, the characters are translated into a user-friendly language. As a result, the user will have quicker access to the unfamiliar language and will be able to interpret it.

Under multi-lingual scenarios, identification of script is an unavoidable step to natural image text understanding. The text identification process for images consists of two steps: localization of text to obtain segmented lines of text , and also identifying the types of these segmented text lines. The second phase, recognising the script types of text in natural scene photographs, is the subject of this research. Convolutional neural networks have recently changed the superior machine learning method for visual tasks due to their high capacity and invariance to translation and distortions, and C.N.Ns are becoming the models for many image classification problems. However, there are two major limitations, these C.N.N-based classification algorithms are not suited for use in language identification. One difficulty is the different aspect ratios of text in the images make any C.N.N classifier. Because C.N.N use fixed size input image. The second problem is lots of areas in different script images are similar, if not identical. Existing solutions employ C.N.Ns to mine discriminative features in order to correctly recognise those perplexing scripts. These approaches, which use patches as C.N.N inputs, are effective at extracting local features from text in images and overcoming some issues discussed before. However, partitioning a scene image into patches results in the loss of some global features and a reduction in overall recognition performance. So here use a single C.N.N to extract local and global characteristics from distinct layers and then combine the two features by upsampling or downsampling.

We combine local C.N.N and global C.N.N in this work for language identification.

A Convolutional neural network (CNN)

Convolutional neural networks(C.N.N) are made of many layers of artificial neurons. The weights of each neuron define its behaviour. When we given pixel values of an image, the artificial neurons of a C.N.N detect a variety of visual features. When you send a picture into a Convnet, each of its layers produces a plethora of activation maps. The most important features of images is highlighted by activation maps. A patch of pixels as input to the neurons, the colour values of images are multiplied by its weights, combined them, and activation functions are applied. Classification layer is the final layer of C.N.N.

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CSMI-AW: Computational System for Medical Image Authentication Using Watermarking

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Abstract. The enormous growth of digital data in the era of information technology (IT) has provided broader scope towards improving the quality of life. However, the technological aspects in various data-driven solutions also resulted in data duplication and malevolent manipulation during the digital data distributions through networks, especially when it comes to images. Thereby the demand to protect the privacy of image data is highly envisioned and a crucial concern in the current scenario. Currently, medical facilities also require protecting medical image data ownership with copyright protection and content authentication to preserve the authenticity of the patient clinical details. The study in this regard introduces a computationally efficient technique, namely-computational system for medical image authentication using watermarking (CSMI-AW) to protect the ownership of the patient chest x-ray images. The system uses the potential factors associated with the spectral domain techniques, such as with Discrete Cosine Transformation (DCT) approach with non-blind detection. The optimized procedure of DCT-based significant technique for message image/watermarking and substitution methods for embedding process makes the CSMI-AW more robust to retain the medical image watermark and watermarked image perceptual quality. It also simplifies the algorithm steps in such a way where it optimizes the performance of CSMI-AW with a proper balance between robustness, computational cost, and embedding efficiency. However, the CSMI-AW system not only ensures a higher degree of security for digital x-ray images but also attains better computational performance with higher perceptual quality of the watermark. It attains approximately 40% better outcome of PSNR and 60% computational improvement. The comparative performance analysis for the traditional approaches shows its effectiveness in terms of computational efficiency and peak-signal-to-noise ratio (PSNR).

Keywords: Medical image watermarking · Spectral domain · Bit-plane extraction · Optimized security performance · Perceptual quality

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Brain Tumor Detection that uses CNN in MRI

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Abstract— Brain cyst is a mass of unnecessary units growing in the brain or the multiplications of normal or abnormal cells that are not essential for the brain, which may even be the cause for death. The brain tumors diagnosis is the initial step of medications which is a time consuming and delineating process by expert radiologist and depends on tumor size, reliability. Magnetic Resonance Image of brain is an important factor to prioritize surgical preparations and in computer aided surgery. In order to augment the effort of radiologists in retrieving the information from MRI, we use this system. This proposed paper have classification method based on Convolutional Neural Network for MR images. The data sets taken from Kaggle and is augmented to get a bigger data set in order to efficiency consequently preprocessing of MRI and proposed model implementations. It also compares the proposed architecture with the VGG16 architecture to compare the accuracy and sub-datasets. The experimental results of the model shows that it have good accuracy and is productive and have very low intricacy rate and comparatively less execution time. Performance comparisons is also done with the classifier in support and the confusion matrix. The VGG16 model acquired an accuracy of 89% and the proposed model acquired a accuracy of 98.2 % with a good accuracy .

Keywords—brain cyst, *Magnetic Resonance Imaging*(MRI), *Convolution Neural Network*(CNN), *VGG 16*(Visual Geometry Group)

I. INTRODUCTION

Globally, almost 330 000 new cases of brain and nervous system cancers were identified worldwide in 2012. China, USA, and India were the top three countries with the largest number of fatalities. The International Association of Cancer Registries (IARC) reported that there are over 28,000 cases of brain tumors reported in India each year, and more than 24,000 people reportedly die due to brain tumors annually. In the U.S in 2021, an estimation of 69,000 adults of age 40+ will be detected with the primary brain cyst, and 71.7 percent of 5 years relative average survival rate for adults will be detected with a primary brain cyst. The estimate for malignant tumors is 21.5 percent and for non-malignant tumors, 90.2 percent. Also an estimation of 11,700 new cases of adolescents and young adults brain tumors will be diagnosed in 2021.The commonest prevalent type of cancer is brain tumors among teenagers only (15-19) contributing towards 2.1 percent of diagnosis each year in this age group. About 70,000 - 170,000 cancer victims are treated with brain secondary brain tumors (metastases) per year, while nearly 100,000 will die from brain metastasis each year. [1] which shows the real importance of detection of brain tumor in early stage. The unnecessary mass of cells growing in the brain which leads to abnormal tissues in the brain is the brain tumor. It has the potential to affect anyone of any age. The effects of a brain tumour may vary from person to person and even from one therapy session towards the next. Brain tumours come in a variety of structure and dimensions, and they can be seen in any position and with varying image contrasts. They are of two types benign tumors or malignant tumors. The benign tumors have a structural homogeneity and do not contain active cells or cancerous cells, however malignant tumors do not have structural homogeneity and contain active cells[1]. Many techniques and medical imaging procedures like Computed Tomography (C.T) examining and MRI (Magnetic Resonance Imaging), can be utilized to find any abnormality in tissues and organs beforehand.

MR image is a rapidly evolving medical imaging method that fabricates a high-resolution images of soft tissues. It is a non-intrusive procedure for the analysis of tissues in our human body [2]. MRI is a specialized tool for brain anatomy research, and it is commonly used for obtaining and conveying anatomical or structural data and in Fig 1 Normal MRI and presence of tumor in MRI is shown. Brain structure recognition using MRI is critical in neurosciences, and it has a wide range of applications, including brain development studies, neuroanatomical studies of the brain, and more. As a result, the majority of MRI data are employed in medical image segmentation for the goal of comprehending and doing research analysis. For brain image analysis, MRI segmentation incorporating learning procedures and pattern identification algorithms have proven to be quite effective. The method provides a parametric model that takes into account selected characteristics using a density function. Because of the transmission or recording media, quantization error, and other factors, MRI images contain a lot of noise.Surgery is the most popular method for brain tumours, chemotherapy and radiation may be utilized to limit the growth of tumours that cannot be removed surgically and are likely to be malignant. One of the most effective approaches used to determine brain cysts is MRI, which provides information images of the brain. Furthermore, using MR imaging to detect brain tumours can improve diagnosis, treatment prediction, and treatment planning.

There are a number of methods used for the image classification to classify whether the MR image is tumorous or not using[10] many techniques like SVM (Support Vector Machine), CNN (Convolutional Neural Network), KNN (K-nearest-Neighbor) etc. Sidong Dumedharan *et al* [3] The proposed technique uses skull stripping for preprocessing and further WMGM and CSF