



RESEARCH ARTICLE

SURVEY PAPER ON PATTERN RECOGNITION

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ABSTRACT

This paper describes about how pattern recognition is used in today's world. Although human has developed many technologies, pattern recognition is one of the technologies which has made human life more easier. Today, pattern recognition plays new, but just as important roles in diagnosing diseases, inspiring new ways to safeguard data, and discovering new planets. In this paper, we describe about different terminologies in relation to pattern recognition and compare the techniques used by humans.

Keywords:

Artificial Intelligence, Machine Learning,
Image processing, Neural Networks,
Computer Vision, Text and Document
Analysis, Deep Learning

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INTRODUCTION

Artificial Intelligence (AI) is an area of computer science which is developed to perform sophisticated tasks having characteristics of human intelligence and includes things like reasoning, problem-solving, planning, learning, and understanding and reading human language which is exhibited by machines or software.

Pattern recognition is the machine-controlled recognition of patterns and regularities in information. Pattern recognition is closely related to artificial intelligence and machine learning, together.

Pattern recognition is one approach to computing, while other approaches include symbolic artificial intelligence and machine learning, together with applications such as data mining and knowledge discovery in databases (kdd).[7]

A modern definition of pattern recognition is: the sector of pattern recognition thinks about with the automated discovery of regularities in data through the utilization of computer algorithms and with the utilization of those regularities it performs actions like classifying the info into completely different classes[8]



Machine Learning

To optimize differentiable parameters, techniques of Machine Learning are often applied. Unlike software package that has been programmed manually and performed tasks with specific directions (like computer Vision software), Machine Learning algorithms are designed in such the simplest way that they will learn and improve over time when exposed to new information. Machine learning (ML) is the scientific study of algorithms and statistical models that computer systems use to perform a selected task while not using specific directions, relying on patterns inference instead. It is seen as a subset of computing[9].

It is the process of extracting structures or answers from images or video or applying mathematical methods to extract or recognize patterns. Pattern recognition is a field which uses

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various methods to extract data from signals normally, in the main supported applied math approaches and artificial neural networks. A significant part of this field is devoted to applying these methods to image data. In case of pattern recognition, computer vision can also be used for detecting faces, fingerprints and even signatures and voice recognition

Machine Learning (ML)

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Deep Learning (DL)

Deep learning, on the opposite hand, could be a specialized methodology of knowledge process and a set of machine learning that uses neural networks and copious amounts of information for decision-making. The learning methods are based on the functioning of the human brain, which also consists of interconnected neurons. Artificial Neural Networks encompass multiple layers of that every is connected to succeeding layer and is liable for a particular task. This design makes it possible to mix and expand what has been learned with new content

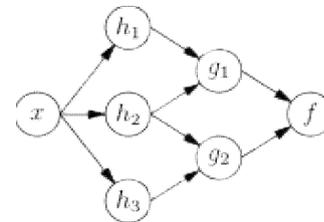
Text and Document Analysis

This includes contributions handling computer recognition of characters, symbols, text, lines, graphics, images, handwriting, signatures, as well as automatic analyses of the overall physical and logical structures of documents, with the ultimate objective of a high-level understanding of their semantic content. Defined as *‘the field that is concerned with logical and semantic analysis of documents to extract human understandable information and codify it into machine-readable form.’* After the lines of text in the page image have been identified (Layout Analysis) and Handwritten Text Recognition performed, we take the results as the input to perform Document Understanding. If we consider a document as a database, instead of mining a database proper, we mine a specific document to find out the sequential that display interesting regularities

Neural Networks

Human brains are most complex things to understand. They do multiple tasks at one time and controls so many organs. It does this things by using neurons which are connected from brain to completely different element of body. A neural circuit is a population of neurons interconnected by synapses to carry out a specific function when activated. Neural circuits interconnect to one another to form large scale brain networks. Biological neural networks have inspired the design of artificial neural networks, but artificial neural networks are usually not strict copies of their biological counterparts [10]. AI is used to simulate this neural networks. Artificial neural networks (ANN) or connectionist systems are computing systems that are inspired by, but not identical to, biological neural networks that constitute animal brains. Such systems "learn" to perform

tasks by considering examples, generally without programmed with task-specific rules. For example, in image recognition, they may learn to spot pictures containing cats by analyzing example images that have been manually labeled as "cat" or "no cat" or to spot cats in different pictures. They do this without any previous data of cats, for example, that they have fur, tails, whiskers and cat-like faces.



An ANN relies on a group of connected units or nodes referred to as artificial neurons, which loosely model the neurons in a biological brain. Each connection, like the synapses in a biological brain, can transmit a signal to other neurons. An artificial neuron that receives a signal then processes it and can signal neurons connected to it. The original goal of the ANN approach was to resolve issues within the same means that a personality's brain would. However, over time, attention moved to activity specific tasks, leading to deviations from biology. ANNs are used on a range of tasks, as well as computer vision, speech recognition, computational linguistics, social network filtering [11]

Applications

Computer vision

The first vision system present created to achieve high-level understanding from digital pictures or videos [5]. Computer vision is an interdisciplinary scientific field that deals with how computers can be made to gain high-level understanding from digital images or videos. From the perspective of engineering, it seeks to automate tasks that the human visual system can do. Computer vision tasks include methods for acquiring, processing, analyzing and understanding digital images, and extraction of high-dimensional data from the real world in order to produce numerical or symbolic information, e.g. in the forms of decisions

Computer Aided Diagnostics

Medical imaging, EEG, EEG signal analysis Designed to assist physicians, such as: X-ray mammography Highlighting potential tumours on a mammogram. Computer-aided detection (CADe) and computer-aided diagnosis (CADx) are emerging technologies to help radiologists interpret medical images. In screening mammography, CADe can help radiologists avoid overlooking a cancer, while CADx can help radiologists decide whether a biopsy is warranted when reading a diagnostic mammogram. Even though there is much commonality in the techniques used in CADe and CADx algorithms, there are important differences in the input data and in the output of the algorithms.

Character Recognition

Automated mail sorting, process bank checks; Scanner captures an image of the text; Image is converted into constituent characters. Character recognition is a process

which allows computers to recognize written or printed characters such as numbers or letters and to change them into a form that the computer can use.

Speech Recognition

Human computer interaction, Universal access; Microphone records acoustic signal; Speech signal is classified into phonemes and words. Speech recognition is the ability of a machine or program to identify words and phrases in oral communication and convert them to a machine-readable format [12].

A primitive speech recognition software system includes a restricted vocabulary of words and phrases, and it's going to solely determine these if they're spoken terribly clearly. More refined software system has the power to just accept natural speech.

Military and Defense

Currently Google is operating with the Pentagon to develop Artificial Intelligence for unmanned combat, and the technology is already being used for tasks like tracking storms patrolling borders, monitoring security and performing safety inspections.

Face Recognition and Insurance Claim Processing

A face recognition system may be a technology capable of distinctive or collateral an individual from a digital image or a video frame from a video supply. There are multiple ways within which face recognition systems work, but in general, they work by comparing selected facial features from given image with faces within a database [4]. It is additionally represented as a Biometric computer science primarily based on application which will unambiguously determine an individual by analysing patterns supported the person's facial textures and form [4].

Fingerprint recognition

A fingerprint is an impression left by the friction ridges of somebody's finger. The recovery of partial fingerprints from a criminal offense scene is a very important technique of rhetorical science [3]. Moisture and grease on a finger cause fingerprints on surfaces like glass or metal [2]. Deliberate impressions of entire fingerprints is obtained by ink or different substances transferred from the peaks of friction ridges on the skin to a sleek surface like paper. Fingerprint records ordinarily contain impressions from the pad on the last joint of fingers and thumbs, although fingerprint cards also typically record parts of lower joint areas of the fingers.

Bioinformatics

Biometrics is gaining immense importance in today's technical world. They are mainly used for identification and authentication purpose. It includes applications like: DNA sequences analysis, DNA micro array data analysis, Research of heredity.

Geography

Earthquake analysis Rocks classification. Geography is the study of places and the relationships between people and their environments. Geographers explore each the physical

properties of layer and therefore the human societies unfold across it.

Military

Pattern recognition can be used in military applications like Aviation photography analysis, Automatism Aim recognition. A missile will follow a particular pattern in order to destroy a target, by using this pattern missile destroyer system can destroy the enemy missile before it hits a target. Similarly, instead of making human aim a gun at output near the border. Automated guns can follow a pattern so that they will cover a particular area. Since humans can get tired or be sleepy, an enemy can easily avoid them and cross the border. Automated guns will help avoid this.

Literature Survey

The paper presents a novel approach to distinguish between various fields of pattern recognition. The science and technology of measuring and analyzing biological data for authentication or identification purpose is called as Biometrics. The system that successfully identifies and measures the biological data from the human body is called as a biometric system. Biometric Systems are computerized methods of verifying or recognizing the identity of an individual on the basis of some physical features or appearances, like a fingerprint or face pattern or some traits of behavior, like handwriting or keystroke patterns [1]. In the present hi-tech world, there is an ever growing need to authenticate and identify people for security purposes. A wide variety of modern systems requires consistent personal recognition schemes to either confirm or determine the identity of an individual requesting their services. The objective is to ensure that the rendered services are accessed only by a legitimate user and no one else, to discourage fraud and enhance security and to specifically identify individuals in corporate areas. The biometric identification method consists of three operations, they firstly capture biometric sample of the person and make a digital representation of the sample, then extract unique features from the digital representation using feature extractor, and then compare the extracted feature set against the template set in the database.

A person in iris recognition system is primarily based on the distinctiveness of the iris pattern of the eye. Basically, iris is defined as a circular region between pupil and sclera of human eye which exhibits bizarre texture that is unique for each individual, responsible for controlling the diameter and size of the pupil [6]. This technique uses a high-quality camera to capture high resolution pictures of iris. A high-quality image of the iris is captured to amass each careful feature whereas remaining noninvasive to the human operator. The pattern of ridges and grooves on surface of a fingertip is fingerprint.

Fingerprints are highly unique and stable for an individual. The uniqueness of fingerprint is determined by three features: Coarse features: Coarse features have strong genotypic influences and are suitable for presorting during identification with a very large data base. Coarse features consist of loops, arch and whorls. Fine features: Fine features, also called as minutiae are the endings and the bifurcating of the finger lines because these follow a strong random pattern. They are the carriers of "uniqueness". Pore structure: Pore structure isn't used, because

it shows massive fluctuations within the quality of the scanning procedure. A biometric identification technique uses an individual's face for identification purpose. This is done by automatically identifying a person from a digital image or a video frame from a video source. The algorithms can be geometric feature-based and appearance-based. 3-Dimensional face recognition systems are most widely used as they provide accurate results because they capture the actual shape of faces. 3D models of faces are made by the system and the 3D faces are compared for recognition. The features used to identify an individual are position of eyes, nose and mouth, cheekbones, distance between eyes, eyebrow thickness and position, face outline, jaw shape. These options are then compared with the information images for identification.

Speaker recognition is a generic term which refers to any task that discriminates between people based upon their voice characteristics. There are two specific tasks that have been studied extensively. These are speaker identification and speaker verification. The difference between identification and verification is simple. The speaker identification task is to classify an unlabeled voice gesture as belonging to one of a set of N reference speakers, whereas the speaker verification task is to decide whether or not an unlabeled voice gesture belongs to a specific reference speaker [2]. Speaker verification does not focus on the sound or the pronunciation of speech itself [3]. In voice recognition "sound spectrogram" devices are used. It is the process used to recognize an individual's signature. It can be operated in two different ways: static and dynamic or offline and online. Static: In this mode, users write their signature on paper, which is digitized through an optical scanner or a camera, and then the biometric system is used to recognize the signature by analyzing its shape. This group is also known as "off-line mode". Whereas the in dynamic, users write their signature in a digitizing tablet. This mode is used as a real time system hence known as "on-line mode".

CONCLUSION

Finding patterns like Face, fingerprints, voice, speech, etc is a challenging problem in the field of image processing and computer vision. Because of lots of application in different fields the pattern recognition has received great attention. In this paper different pattern recognition applications are mentioned. Like a coin has two sides. Each technology has its own advantages and disadvantages. Pattern recognition similarly has its disadvantage like you can copy a fingerprint and easily get access to the confidential or private information.

You can get face of person on another device and then make device which you want to access face that device, it will detect the face as original human face and unlock it. Pattern recognition is developing field and it may take some time to completely understand patterns as accurate as humans. Simple, repetitive tasks is delegated to technology whereas humans are left to create vital strategic selections that ultimately improve output whereas saving cash at an equivalent time.

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