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Anush K
School of Computer Science
and Engineering, Vellore
Institute of Technology,
Chennai Campus, Chennai,
Tamil Nadu, India

Image recognition in financial sector: Present and futuristic machine learning developments

Anush K

Abstract

Image recognition in the financial sector is a popular and upcoming system which has machine learning and theory of computation as its foundation. It is a process by which images and other pictorial data are collected, organized, and used according to the requirements of the user. In the financial sector it is used as a tool of identity verification, information retrieval security systems and more. The main branch cited in this paper regarding this process is machine learning. This is a study of algorithms of a system used to learn a trend in the data by experience and using it to make future developments. This knowledge along with computational theories has been already used to make numerous advancements in this field at present. In this paper, first, we explain about the existing methods of this process in detail. Since this technology has just started to attract attention in the sector, it still has a lot of scope for upgrades that are yet to be learnt and implemented. These future implications and potentials of the process will also be pointed out in this paper. As a conclusion to this paper, results of existing and futuristic enhancements of image recognition will be discussed with appropriate citations for technical issues and their viable solutions.

Keywords: Image recognition, financial sector, machine learning, artificial intelligence, data security

Introduction

This research paper is written with the aim of giving a detailed description and analysis about the usage of image recognition techniques in general and in the financial sector using machine learning and deep learning concepts. It also provides a study on the potential of this technique in future and the technical challenges that it might face.

Image Recognition (IR): IR is the capability of the computer software to recognize places, people, objects, and words which are in the form of images and use them to collect meaningful data ^[1]. It uses a set of algorithms to denote and categorize useful information that are present in the image as per the needs of the user. It takes the image as an input and produces the collected and organized data about it as output with the help of a machine learning algorithm.

Machine Learning (ML): ML is the study of computer algorithms which enhances itself with experience and by learning the trend of the data ^[2]. It is considered as a part of artificial intelligence. It is a fairly established and yet upcoming field of computer science which has a lot of potential to improve and aid numerous fields of computing to the next level. The main principle of machine learning is to generalize from experience of past datasets even when it is given a new and unseen task. It must be able to analyse the trend and create a standard model of completing tasks as per the specified requirements. This study is used in a vast set of fields starting from agriculture to automated vehicles. In this paper we would be explaining specifically about the usage of machine learning and image recognition in the financial sector.

Overview of the Research Paper

This research paper has been structured in a way as to provide proper and categorised explanation and major points on the specified topics. First, we would be knowing about the ideal scope of image recognition and machine learning in the financial sector. Following this, a detailed description about the existing technologies and methods of these domains would be given with regards to the financial sector. Dedicated explanation on working of these technologies in the data extraction, stock market analysis and related financials segments would be provided.

Correspondence

Anush K
School of Computer Science
and Engineering, Vellore
Institute of Technology,
Chennai Campus, Chennai,
Tamil Nadu, India

Next, we would be exploring the various ways through which machine learning and image processing can improve the future of the financial sector. Some major and specific examples have been cited in this section. Along with this, we would also briefly discuss the future of these technologies in other general domains. At the very end, a detailed description would be given about the upcoming challenges that machine learning and image recognition might face in the future with regards to the financial sector. These challenges have been predicted by analysing the current trends and knowing the capacity of these technologies in the specified domain.

Before concluding, a small attempt has been made to find possible solutions to the above-mentioned challenges and see how the sector can adapt and overcome them in the future. References for helpful websites have been provided after the conclusion for future need and verification.

Scope

The ideal goal of image recognition is to achieve as much efficiency in identifying and understanding the details and data which are in the form of images as how a human would be able to. With the help of machine learning, it must also go a step further and predict how the trend is and generate models to solve tasks that may come up in the future. In the financial sector, like any other field, these characteristics of machine learning and image recognition are very vital as they help in making the transactions and related processes easier. Though the complexity of processes and the high importance of the dealings make this sector slightly trickier to adapt to innovations and changes, with proper implementation of these techniques, some of the longstanding problems of the financial sector can be solved with high efficiency and in very less time.

With regards to the financial sector, some of the main uses of these techniques are

- Identification
- Authentication of transactions
- Cyber Security
- Automatic Document Information Extraction
- Stock market forecasting
- Transaction management
- Analysis of outcomes
- Customer experience management

It is also important to keep in mind that while solving these problems, there must be no reduction or negligence in the security and safety of the data used. As most of these data are sensitive the model generated by these techniques must make sure to keep it safe and not cause any damage or corruption to it. These are some of the expectations of using machine learning and image recognition in this sector. In the following section let us discuss the real time applications of some of these uses.

Image Recognition and Machine Learning in Financial Sector: The Journey So Far

The financial sector has seen some phenomenal developments with the implementation of image recognition and machine learning in it. Automating human tasks in different domains by finding a pattern and generating models for it has been the primary task of these technologies. Though these processes can still be developed and improved, its current research, potential and

applications are clearly astounding and promising. Some of the current applications of these technologies have been explained below.

Authentication System

The need for security of data and fraud prevention has been a very important aspect to be considered in any field. In order to achieve this, proper methods must be in use to detect, prevent and mitigate such unwanted security breaches. Image recognition plays a vital role to make this possible with its near-failproof technologies and algorithms. Face and biometric recognition are the methods used to ensure the security of data and related information. It is a technology which is capable of detecting the person and their biometrics with the help of images, videos or audio-visuals provided during the verification process. Unlike other security systems like pin, passcode etc., face and biometric recognition uses unique mathematical and dynamical patterns making it one of the most secure and improved safety solutions^[3]. The recognised patterns are stored in the database and compared each time a new login or access request is made by users. With the advanced mathematical and detection algorithms, the verification process happens instantly with accurate and detailed results. This ensures that only authorized users have access to the data while any form of fraud is successfully detected and prevented without the requirement of human intelligence.

Stock Market Forecasting

This is one of the most analysed and popular branches of the financial sector. There is always a need to know the trend and predict the nature of the graph to be successful in investing. The constant change in the stock market makes it a perfect place for machine learning based technologies to be used and developed very efficiently. Pattern recognition is a very useful and efficient technology for this aspect of the financial sector. It is one of the applications of machine learning and can be further enhanced with image processing techniques. Pattern recognition is majorly used in security and statistical analysis of data with the aid of machine learning and image processing to get meaningful information from the graphs, charts and other descriptive images^[4]. This is then used to predict the future trend of the stocks, based on past experience and current pattern. These results generally have higher precision than human made analysis as the algorithms work very efficiently and fast too.

Automatic Information Extraction

This usage of image recognition and machine learning is gaining a lot of importance currently as many major segments of workflow are trying to be automated in the industry. Apart from understanding textual data and analysing it, it has become a necessity to observe images, videos, and similar multimedia's to analyse, interpret and collect data from them. This would definitely reduce a lot of demanding human work and also completes them with higher accuracy and speed. One of the well-known techniques regarding this segment is Optical Character Recognition (OCR). It is widely used at present to detect and extract text from images and documents. It uses various characteristics like text density, structure, fonts to segregate text from other unwanted data. These techniques have been slightly successful in achieving the target of extracting information from non-textual sources^[5]. At present Google

lens has made it possible to know more about the object that is brought under its focus. It immediately starts the text recognition algorithm and provides relevant information about that particular object. In addition to texts, they have also had slightly measurable success in reproducing the same with images and other actual objects in the real world.

Ideas which were very hypothetical and unclear are now becoming a reality and have started to gain a lot of exposure and create interest in people. This has been possible mainly because of advancement in machine learning and image recognition technology.

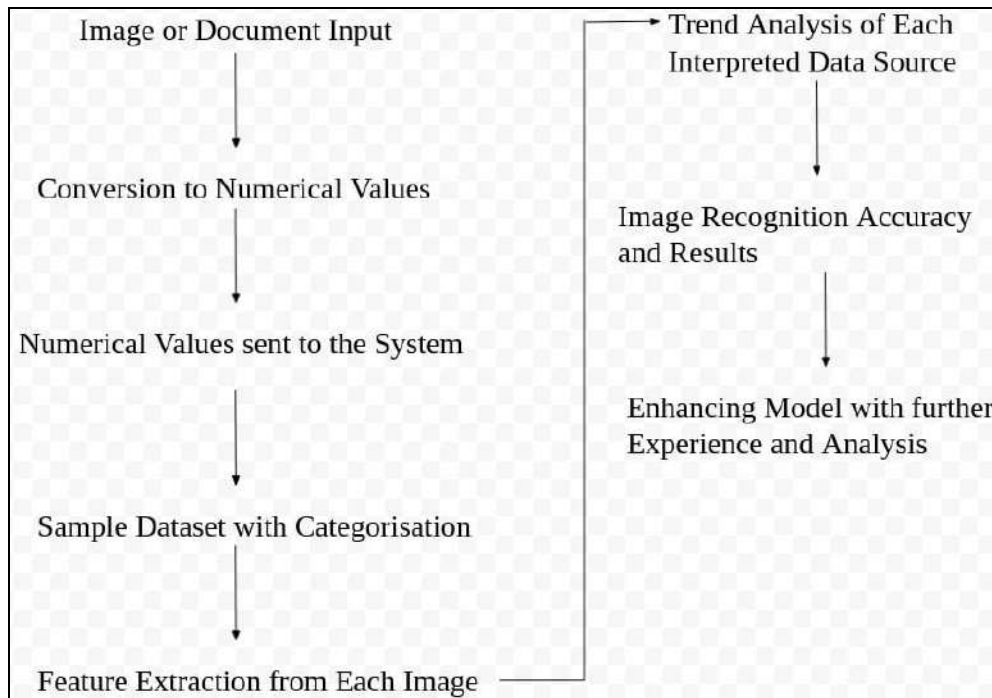


Fig1 Image Recognition Roadmap Diagram ^[6].

Automated Insurance and Loan Transactions

The task of providing loans and insurance is extremely tedious. The background details of the user must be thoroughly verified based on the data collected from them. Using this the eligibility for loan and insurance must be checked according to the situation, and proper transactions must be made and monitored once all these documents are verified to be authentic. Machine learning algorithms and image processing help a lot in automating this process by getting details from the user in the form of documents and then extracting the useful data from it. Verification ids can also be recognized and cross-checked with the database to know if the user is authenticated or not. These techniques can also be used to calculate and assess the credit score of individuals to check if they are eligible for the service or not. It reduces a lot of human effort and also increases the accuracy and speed with which these processes are completed. Thus, it has been very clear that the techniques of image recognition and machine learning have been working very well for many fields and user requirements. In the financial sector, the current developments have really been helpful in semi-automating many important day-to-day tasks. This has not only saved a lot of time but also reduced the energy, work-force and tireless effort required to complete these tasks. With further enhancements and improvements in these technologies, there is no doubt that these core processes would surely have a lot of demand in every available sector in the near future.

Futuristic Developments

A technology as popular and useful as image recognition is surely to be improved and researched on a deep scale in the

near future ^[6, 7, 8, 9, 10]. Its potentials are yet to be completely unveiled, so that the resource is used much more efficiently to solve many major, related issues faced in the industry. It is needless to say that machine learning and artificial intelligence have become the most concentrated areas for developments at present and in the future. Thus, it is more likely that all its related techniques see a major enhancement in their standards. The following sections explain and predict these futuristic developments that may take place with regards to image recognition and machine learning in the financial sector as well as in general domains.

Financial Sector Developments

Anti-Money Laundering (AML) Pattern Detection

In the past few years, there has been a noticeable increase in the number of frauds and scams in financial transactions. Each time the method in which the forgery is executed keeps improving and is constantly finding ways to cheat the existing security system by finding suitable loopholes. It has now become a dire need to detect, prevent and put a permanent stop to these malpractices in order to keep the data and financial resources secure. Most banks, financial services and insurance institutions (BFSI) have recognised this need and have slowly started to shift from rule-based software systems to an advanced machine learning and AI based security structure ^[7]. As machine learning technology is sure to detect patterns and improve its algorithms to be on par with it, fraud detection would become a lot more efficient and reliable. These advancements would help every country achieve corruption-free, efficient and quicker processing of data with no frauds, fake accesses and scams in the future.

Advanced KYC process

Verification and authentication of new customers has always been a tedious work in the BFSI sector. This is the first and most important step, where malpractice and fake access requests can be detected. The details of the customer need to be collected and it must be verified by the sector employee to be authentic as per the rules specified by the organisation. Using image and video processing, these details can be collected by a video call alone without going through the tasking procedures of manual collection of data. The total process is reduced from hours to minutes solely because of the advancement in machine learning [8]. The collected data can be surely believed to be highly accurate and would certainly have lesser errors and cheats. This makes the technology very reliable and efficient when compared to the existing methods.

Sequence Prediction

This section deals with the most researched and improving part of machine learning. Analysing and predicting the nature of the financial market, not only helps customers and investors to be successful in their ventures but also gives a reliable platform for the organisations and governments to make appropriate economic decisions and bills. Researches show that the highest error in the analysis done using these technologies is around 5.18%. This rate shows almost 20% less errors than any other algorithms [10, 11, 12 and 13]. The system must be able to accept data in the form of images, videos, graphs, charts etc. and interpret the meaning conveyed by them. Using this, it must be able to accurately predict the outcomes of various ventures that the user is interested in and also give proper guidelines as to which steps and plans would be relatively beneficial to the users among the methods that are available.

At present there are basic ideas of implementing these techniques to make the sector much more productive, but they have not been successfully and widely implemented in most industries due to many challenges and technical glitches. Achieving this in the near future would certainly be of immense benefit for the sector and the country as a whole. These advancements in technologies show the capability of the country in scaling up its economy in a quicker way possible.

Cashless Society

Making the country cashless and thereby reducing corruption, frauds in the financial sector has been an ideal dream for the entire world for a very long time. This has still not been implemented on a large scale due to lack of resources to monitor and ensure its proper functioning in every stage of the process. The main reason for this is the lack of awareness and knowledge in people to know these advanced processes and the huge amount of effort that is required to implement these manually. But in the future, with advancements in machine learning and optical recognition, most of these processes can be automated with the knowledge required only on the system side. All necessary data from documents could be extracted with the help of image processing regardless of the format of the document.

When data collection is made this easy, its segregation, processing and future predictions can also be slowly automated with the help of artificial intelligence and deep learning. Soon there would be very less or no necessity for

human intelligence and effort in completing these tasks efficiently. Moreover, these processes done by machines are a lot more accurate, reliable and can also be done tirelessly for hours together with the same precision. This would surely result in an extraordinary improvement of the sector and make its long-term goals easily achievable.

Challenges and Viable Solutions

Being an intensively researched technology, it is expected that there would be few issues and challenges that it would face when implemented in the industry. Most of these challenges are present now only because of the ongoing research in these areas [14, 15, 16, 17, 18]. With more study and advancements some of these issues may be totally avoided while others can be minimised effectively.

Accuracy

An ideal data processing model must have complete precision always. However, there has never been a case of 100% accurate result with the usage of image recognition till now. Since each data source document has its own way of portraying the data and as it is impossible to provide data only in a specified manner, the algorithms tend to have errors while detecting and segregation useful content from unused ones. An effective solution to this would be to improve the efficiency of the algorithm by maximising the sample data provided to it to generate a model. With a higher amount of sample data, the calculations and predictions would automatically be more accurate. However, achieving 100% success in this at all times is highly impossible with even very advanced techniques as there always tends to be new regions of data which the system might not have experienced or analysed before. While it is not possible to totally solve this issue, the rate of error can surely be reduced systematically in the near future.

Numerous Methods for Problem Solving

This challenge occurs due to the existence of various methods used to complete the same task. As each method uses a different approach and the requirements to vary accordingly, it becomes difficult to reuse these methods in other systems. The system which uses one method may not be compatible with the one using other methods. This may cause problems when they both work together in a certain task.

With the increase in the amount of data that is available for interpretation in recent times, it would be very tedious if each system comes up with new methods of solving the same problem without any coordination between them. This would not cause a lot of chaos but also result in serious data losses and misinterpretation which are even more dangerous and must be avoided at all costs. A unique methodology to solve certain problems must be adopted by all systems in general and other specific deviations in the method must be implemented only if it is definitely necessary. This would reduce the confusions caused by multiple methods and would also help in joint working of different systems without the issue of incompatibility.

Mismatched Facial Recognition

One of the major problems that image recognition is facing at present is that it fails to accurately detect the face of the user if there is striking similarity between multiple faces. The algorithm considers them to be the same and hence

allows access to the data for similar-faced users too. This problem has been faced by many mobile manufacturers as their phone face recognition passcode fails to provide adequate security if it happens to be tested with a slightly similar face.

Steps have been taken to solve this problem by improving the efficiency of the algorithm and providing more data points to be interpreted and validated by the system. This reduces the error shown due to mismatch of the recognized face. Combining face recognition with biometric verification such as fingerprint can add more security to the data with two step verification. These techniques are being implemented now and will be further enhanced in the future.

Data Security

There has been a lot of opinions and debates that the security of data has been lost due to sudden increase in automatic image processing. People feel that their privacy and security have been compromised without their consent which may or may not be true according to specific cases. In addition, these technologies, if used unethically, can be very harmful and threatening to the society as numerous private data may be easily collected with or without the knowledge of the users. Though these technologies are being extremely helpful to the society, it must be ensured that these are used only in an ethical and moral way. Any threats caused to the safety and privacy of users would result in complete abandonment of these technologies and would create an insecure impression towards it. Further, Data and image encryption is a viable solution to limit these issues and prevent unnecessary illegal access and attacks ^[10]. Proper segregation and reliable storage of data would certainly be beneficial for the users to believe and know that there is no threat to their data and themselves due to these technologies.

Conclusion

This research paper has been completed with detailed description about importance and usage of image recognition and machine learning in the financial sector. It is clear that these technologies have played a very important role in improving the state of the financial sector and would continue to do so in the future with proper developments. The advancements of these techniques would help in predicting the trend and also analyse the past experiences to improve on the tasks that are currently carried out. Apart from the financial sector, a few examples of the general implementation of machine learning and image processing have been discussed as required. The enhancement of these fields due to machine learning has also been undeniable.

Explanation regarding the existing methods of image processing, machine learning, artificial intelligence and their applications were also provided. Later, futuristic developments of these technologies and the challenges that might be faced by it in the near future have also been explained detailed. In addition, possible solutions have been suggested to solve these issues as efficiently as possible without causing any further problems. As a widely existing and rapidly growing field of study, image recognition and machine learning would certainly benefit society and industry in making most tasks automated and efficient. This would result in the betterment of many major sectors and improve the status of the country to a great extent.

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