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Role of Machine Learning Techniques

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Abstract

The main aim of this study is to discuss the Role of Machine Learning Techniques on Image Content Management.

The thesis is advancement in the field of AIA that will improve image retrieval performance. The suggested approach comprises three basic stages: segmentation, feature extraction and annotation. Shape images are segmented using edge detection techniques, whereas colour images are segmented using thresholding, region-based, and clustering-based techniques. K-means clustering on the brightness level of an image results in clusters creating image regions. Feature extraction is the process of transforming high-level features into low-level semantics. Shape characteristics that are rotation, scaling, and translation invariant are chosen. The fundamental RGB and L*u*v colour model is utilised for representation of images in colour characteristics. Mean oriented energy is calculated by extracting texture features with gabor filters. Annotation is performed utilising machine learning techniques such as artificial neural networks (ANN), hierarchies of ANN, rough sets, decision trees, k-nearest neighbour (KNN), and multiple instance learning (MIL) with K-NN. The text based search assesses retrieval performance which in turn measures annotation accuracy. During annotation the novelties are first introduction of new classifiers such rough sets used for tagging and second the creation of architectural framework of the classifiers.

INTRODUCTION

As the Internet expands and storage devices become more affordable, text, images, graphics, video, and music are increasingly being stored digitally. The form, texture, and color qualities of the query image, as well as images in the database, are commonly used to extract these attributes. Trade, education, criminal prevention, and biomedicine are just a few of the many possible applications for digital libraries and search engines.

Because vision is the most important sense for humans, images have always played an important part in our lives. A vast range of applications for image processing may be found as a consequence (medical, military, etc.). In today's world, photographs are more prevalent than ever before, and owing to advances in digital technology, anybody may produce a large number of photos. Standard image processing algorithms must cope with more difficult issues and their adaptation to human vision with such a large number of pictures. Adaptation in intelligent computer vision programs has necessitated the use of machine learning because of the intricacies of vision (e.g., face recognition). An increase in adaptability often comes with a rise in complexity, and any machine learning approach must be effectively regulated so that it can handle image processing challenges adequately. For one thing, it's difficult for most machine learning algorithms to deal with large amounts of data, often with high dimensions, which is the case when it comes to image processing. As a result, model selection processes must make use of interactions with image data and image priors.

CONTENT-BASED IMAGE RETRIEVAL

Content-based image retrieval seeks out images in a vast collection that are similar to a query image. An image's ranking for retrieval is often based on how closely its representative characteristics match those in the dataset photographs. First, a wide range of manually created feature descriptors for pictures based on visual signals like color, texture, shape and so on were studied. To replace hand-designed feature engineering, deep learning has gained prominence over the previous decade. It automatically learns the characteristics from the data.

Since then, the term has been used to describe the process of sifting through a large array of images to pick the best ones based on their color, texture, and shape. Preferably, the extraction process should be fully automated, regardless of the retrieval features. CBIR is not what we call image retrieval when we use manually supplied keywords, even if those keywords represent the content of the images.

In contrast to traditional information retrieval, CBIR relies on unstructured image databases since digital pictures are nothing more than a collection of pixel intensities. Prior to any sort of reasoning about a picture's content, it is necessary for image processing to extract useful information from raw data (such as determining whether or not a given form or texture is present).

What is Content-Based Image Retrieval (CBIR)

Digital photographs can be organized based on their visual properties using Query by Image Content (QBIC). Image retrieval in large datasets is solved using computer vision algorithms.

- Image retrieval relies on features taken directly from image data rather than keywords or annotations.
- Extracting photos from a collection based on their resemblance. An image's intended content can be deduced through the use of character quantity extraction techniques. Furthermore, appropriate querying, matching, indexing, and searching strategies are necessary.
- Using a set of attributes and image descriptors, this framework locates, obtains, and displays images that are similar to one given as a query.
- The representation, organisation, and search of images based on their content rather than image annotations.
- Image indexing and retrieval systems that make use of image contents, or low-level (basic) image properties such as colour, forms, textures, and so on. Images are often used to represent queries (sketches or image examples).
- "Is a solution for solving image retrieval problems in huge datasets that employs computational vision and pattern recognition approaches. Color, texture, and other visual characteristics are employed to create a feature descriptor."

LITERATURE SURVEY

Chris Kelliher (2022) Machine learning may be used to improve the methodologies that have already been introduced, and this is demonstrated in this paper. Starting with the fundamental distinctions between econometric and machine learning-based approaches to revealing a signal, we point out that cross-validation is a phase that is specific to machine learning. The differences between supervised and unsupervised machine learning algorithms are then discussed, with an emphasis on the most frequent algorithms for each type of method. On to the next step, which is the introduction of clustering techniques and demonstration of how they might be applied to finance in the context of clustering assets or market settings After that, we'll go through some of the most powerful categorization approaches that machine learning algorithms can use, such as Support Vector Machines and Logistic Regression. In the following section, we examine potential interpretability difficulties associated with particular machine learning methods and propose some techniques for creating models that are understandable. Finally, we cover alternative applications of machine learning in finance, such as in optimal execution or delta-hedging, as well as in credit risk modelling and simulation.

P. Ajay et. al, (2022) Suppliers, distributors, manufacturers, and customers are all part of a chain of organisations known as the supply chain. It must be steadfast in its efforts to improve customer satisfaction. To share and integrate data, the organisations involved must work together to achieve consensus. The real world and the ideal world for supply chain networks, on the other hand, are worlds apart. This is due to the fact that the supply chain contains both well-known and obscure elements and concepts. As customer demand has grown exponentially, the way products have been used since the early 2000s and how they are being used today are two very different things. We need a supply chain strategy that works in order to satisfy the market's demand. As a result, Machine Learning became an important factor in analysing and providing the best solutions to this problem. An overview of machine learning and the interpretation of some models under it will be presented in this chapter, along with examples of its practical application in Supply Chain Management. With the aid of a case study and in-depth examination, we'll examine all of its various aspects and parameters. This will give an in-depth look at the benefits and drawbacks of using ML in SCM, as well as its future prospects.

N. Bharathi, B.S. Rishiikeshwer et. al, (2022) Data pre-cleansing is the first critical step. In order to extract insight or judgment, the pre-processed input must be fed to the appropriate Machine Learning (ML) model. The model's performance is entirely dependent on the characteristics that are included in the model. If you don't know how to choose features, it's impossible to design a great model. Choosing the right feature is essential to creating an accurate model. There are a wide variety of methods for extracting and selecting features in the literature. The model's performance might be seriously hampered and its complexity increased if it contains irrelevant elements. However, even if characteristics describe the record in an efficient manner, it is difficult to depict the record with less features using an ideal methodology for forecasting an unknown record accurately. Appropriate feature selection procedures are employed to deal with such difficulties. This chapter, therefore, focuses on several feature selection methods and their advantages and disadvantages. A python case study is used to bolster the argument. The model builder can use this chapter's plug-and-play technology to create an accurate model.

Abdulhamit Subasi (2022) Mathematical models are constructed using statistical theory, with the primary purpose of making conclusions from a small sample size. Model representation and algorithmic interpretation must be competent after they have been constructed. An algorithm's ability to classify data may be as important as its accuracy in some cases. Many domains, including forecasting, anomaly detection, and biomedical data analysis, rely on machine learning as a decision support tool. The goal of this chapter is to assist scientists in selecting an appropriate machine learning technique and guiding them using optimal strategies using real-time databases, as well as to familiarise readers with the fundamentals of machine learning before delving into solving real-world problems with machine learning techniques. Artificial intelligence, data mining, COMPUTER SCIENCE & ENGINEERING, data science, natural language processing, deep learning, mathematics, and statistics are just a few of the topics taught. Topics relating to various machine learning techniques, such as supervised, unsupervised, and reinforcement learning, will be investigated, and hence significant machine learning algorithms will be discussed in this chapter. As examples, suitable Python functions will be shown at the end of each section. The majority of the examples are adapted from the Python–scikit-learn framework and Tensor Flow.

METHODOLOGY

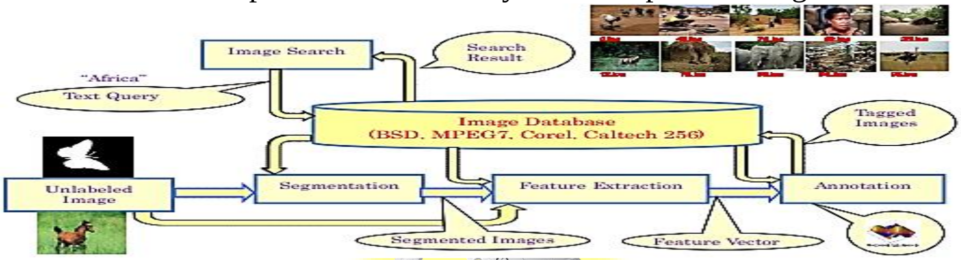
This section discusses the architecture proposed by preliminary research from the evaluated literature. The proposed system is divided into three key parts. Training is a crucial component of any system that makes use of a database of annotated images. In the second phase, the trained system works on raw data to output the annotated image, and in the last phase, image retrieval should be performed to evaluate annotation outcomes.

In the first phase, training, a typical training database that has been segmented is employed. Annotations are necessary for text-based image retrieval. Annotation adds semantic information to photos to improve retrieval performance. The segmentation method generates regions, from which features can be easily extracted by comprehending the contents of the images. The next step is to model the features using a learning technique. It creates an annotation model in order to annotate new photos.

The un-annotated image is used as the input in the second phase, and it is segmented to give regions. The next activity is feature extraction, which generates visual characteristics of the contents to be applied to the annotation model that was trained in the previous phase. The model created in the preceding phase will apply appropriate semantic labels to the image based on its contents. As a result, the output will be an annotated image.

ARCHITECTURE OF AUTOMATIC IMAGE ANNOTATION SYSTEM

In the research work carried out, the proposed system in section 3.1, the architectural framework, is created and implemented. The created annotation system performs three main operations: picture segmentation, feature vector construction, and learning and tagging. The framework of the automatic picture annotation system is depicted in Figure



Automatic Image Annotation Framework

The framework accepts two types of images as input from the image dataset: form image objects (black and white images) and colour images. If the input image is a form image, it is segmented using the canny edge detector; otherwise, it is segmented using the clustering algorithm. Segmentation is investigated using six edge detection strategies for form tagging and grid division of colour images, as well as four segmentation algorithms. The framework's second module is feature extraction and feature vector preparation. The edge detection border gives the contour of the shape from which geometric features are retrieved, and the vector is then prepared for learning by picking salient features. Color strength of images can be considered both globally on the entire image and locally on patches from grid-based segmentation. Color strength is taken from the split regions at the local level. Using the discrete gabor wavelet transform, the texture is retrieved. To extract textural features, the mean and standard deviation of the magnitude of the converted coefficients for 6 orientations and 5 magnitudes are obtained. The system framework's next stage is machine learning.

DATA ANALYSIS AND RESULTS

IMAGE SEGMENTATION

Splitting up an image into meaningful structures is known as segmentation, and it is the process by which a digital image is broken up into several parts. Segmenting an image is a common practice in image analysis, object representation, visualization, and a number of other image processing operations. Because of this, an image's depiction is given new depth and significance. It's common to use the term "segmentation" to distinguish between interesting and uninteresting parts of a scene, as well as between foreground and background material. When a picture is broken down into smaller, more uniform chunks, the user has an easier time deciphering what is going on. Grid-based and content-based image segmentation techniques are the most often used. Grid-based techniques are the simplest and use a grid pattern to split the image without consideration to its content. Depending on the characteristics used to segment, content-based techniques can be divided into a variety of categories.

Figure Segmentation of Image

Using a 4 by 4 grid and a content-based technique, Figure shows an original image that has been segmented. In order to identify the region's boundaries, shape-based retrieval must be used. In order to do this, edge detection techniques are employed. SNR, PSNR, and root-mean-square error are some of the metrics used to assess the effectiveness of edge-based segmentation (RMSE). Rand index (RI) and probabilistic rand index (PRI) allow comparisons between segmentations conducted by various algorithms and hand segmentations subject to human intervention, making it feasible to conduct quantitative valuations of financial assets.

CONCLUSION

Segmentation, feature extraction, and annotation are all steps in the system framework proposed in this thesis for automatic image annotation. Four standard datasets were used to build and test the annotation system. Because the quantity of digital photographs in both public and private collections is continuously increasing, image content analysis technologies are needed. Any digital image collection can be beneficial if the user can extract required content from it. Image content management is a method for organizing and retrieving photographs from a collection. The automated system's goal is to interpret the contents of the image by employing the features in the contents, which can vary in quality and size.

Segmentation is used to distinguish regions of interest by dividing an image into pieces. The shape's border must be extracted before the shape photos can be tagged. Edge detection techniques are used to accomplish this. When compared to gradient-based approaches, the results of Laplacian-based edge detection are superior. Gradient-based algorithms have the disadvantage of being extremely sensitive to noise. They may increase the signal-to-noise ratio, but they also cause erroneous edge suppuration.

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