بسم الله الرحمن الرحيم

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تم رفع هذه الرسالة بواسطة / سامية زكى يوسف

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

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Content Based Image Retrieval

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Abstract

Multimedia became a primary aspect for all different social and business categories. This day, societies figure out using images, videos, and sounds. Productions, marketing, and people's communication depend on social media using texting and multimedia. Servers hold huge datasets according to the huge numbers of users and their media. The search became a daily manner. Search by text is very easy for the labeled datasets but a search by image is very useful for unlabeled seen. Last few days search by image became a trend for many search engines. Developers built different programs to help users find locations, shops, people, and objects using a single image. This technology is called content-based image retrieval (CBIR). Content refers to the whole image or part of the image. Unfortunately, there is no accurate retrieval accuracy over the huge image datasets. Researchers find in the CBIR topic hot challenging points to propose more accurate models using intelligent methods with the lowest complexity.

In this thesis, we proposed recent approaches using machine learning and deep learning to classify images into categories and retrieve relevant images to the input image from different sizes of datasets. Image classification is a part of computer vision and it splits the datasets into categories to make the retrieve operation easier.. In this study, we utilize various types of algorithms such as; supervised, unsupervised and deep learning. Convolution neural network (CNN) is applied as a main deep learning model. We proposed a model using CNN, model fused CNN with recurrent neural networks like LSTM and GRU, and model fused it with traditional algorithms like Decision tree (DT) and Support Vector Machine (SVM). Also, we used a variety of datasets in sizes and types. The datasets is an important factor to measure the evaluation of the CBIR system, so we used different datasets in types and size. There is many images type like; people, objects, medical and digital numbers.

The first model applied in the small dataset to train and classify the images into ten categories. The model fused SOM+ MLP is used to train the dataset with 100% recognition accuracy. The second proposed approach applied to biomedical images which are the X-rays chest images to classify the images into three categories; infected chest with covid-19 virus, infected chest with other viruses, and normal X-ray chest. The model

applied CNN for feature extraction and classification and the accuracies reached 96%, 95%, and 99.5% for the three classes: Covid-19, Pneumonia, and normal chests. The model achieved the highest accuracy in compare to the state of the art techniques for Covied19 classification.

In The third proposed approach, CNN model is applied to two types of images to classify them and evaluate the CBIR approach. The first dataset type is a single object image and the second is a digital numbers dataset image. The models applied on Cifar10 and Mnist datasets. The CNN model achieved 92.9% mAP for Cifar10 and 99.8% for Mnist dataset. The model achieved the highest accuracy compared with the state-of-the-arts on both datasets. The fourth proposed approach is for weather images classification. The proposed technique fused CNN with two different traditional supervised algorithms DT and SVM to classify the weather images into five categories shiny, sunny, fogy, cloudy, and rainy. The study reached 92%, 63%, 94% average accuracies for CNN, CNN+DT, and CNN+SVM models. The models achieved high accuracies in contrast with the state-of-the-art and can help in weather forecasting to reduce transportation accidents.

The last proposed approach is the CBIR approach that used three deep learning models. The three models are similar in the feature extraction phase but use different techniques in the classification phase. The models start with extracting the important features from the images using CNN, classifying them into categories, retrieving the relevant images to the input image from the trained dataset, and finally evaluating the CBIR process using the measurement metrics. The classification for the first model used the fully connected layers but used LSTM and GRU in the second and third models respectively. CNN+GRU achieved the highest results with high complexity reduction compared with the state-of-the-art models. CNN+GRU reached 97%, 91.5%, and 99%, 96%, 87.5%, and 99.9% for Corel1k, Corel8k, Aloi 74K, Cifar-10, Cifar-100, and Mnist dataset respectively.

The study made extensive research on different images to detect the object, classify images, and return the most relevant images. Classification is a very powerful technique that can help in many fields like face recognition, biomedical diagnosis, object detections, and CBIR. The proposed models based on machine learning and deep learning

were effectively increased the classification accuracy and the CBIR performance for different datasets types. The study presented four deep learning approaches and one machine learning with the highest accuracies compared with the state-of-the-art models.

List of Publications

1. Ghaleb M.S., Ebied H.M., Shedeed H.A., Tolba M.F., " Image Retrieval based on self-organizing feature map and Multilayer perceptron Neural Networks Classifier." Ninth International Conference on Intelligent Computing and Information science (ICICS), pp. 189-193, Cairo, Egypt, 2019.
2. Ghaleb M.S., Ebied H.M., Shedeed H.A., Tolba M.F., "COVID-19 X-rays Model Detection Using Convolution Neural Network," International Conference on Artificial Intelligence and Computer Vision (AICV2021), Springer International Publishing , pp. 3-11, Morocco, 2021.
3. Ghaleb M.S., Ebied H.M., Shedeed H.A., Tolba M.F., " Content based image retrieval based on convolutional Neural Network." tenth International Conference on Intelligent Computing and Information science (ICICS), pp. 149-153, Cairo, Egypt, 2021.
4. Ghaleb M.S., Ebied H.M., Shedeed H.A., Tolba M.F., "Weather Classification using Fusion Of Deep Convolutional Neural Networks and Traditional Classification Methods," IJICIS journal , Cairo, Egypt, 2022
5. Ghaleb M.S., Ebied H.M., Shedeed H.A., Tolba M.F., "Image Retrieval Based on Deep Learning," Journal of System and Management sciences, JSMS , Q3, indexed in Scopus, accepted 2022.
6. Ghaleb M.S., Ebied H.M., Shedeed H.A., Tolba M.F., "Content Based Image Retrieval Using Fused Convolution Neural Network" The 8th International Conference on Advanced Intelligent Systems and Informatics (AISI2022), accepted 2022.

.

Table of Contents

List of figures

List of Tables

List of abbreviations:

Abbreviation	**Stands for**
A	Amplitude
AI	Artificial intelligence
ANN	Artificial Neural Network
BFS	Based Feature Selection
BSIF	Binaries Statistical Image Features
CBIR	Content-Based Image Retrieval
CEDD	Color and Edge Directivity Descriptors
CNN	Convolutional Neural Net-works
CT	computed tomography
DL	Deep Learning
DWT	discrete wavelet transform
FV	feature vector
GLCM	Gray-Level Co-Occurrence Matrix
GRU	Gate Recurrent Unit
HSV	Hue Saturation Value
IR	Image retrieval
K-NN	k-Nearest-Neighbor
LSTM	Long Short Time Memory
MR	magnetic resonance
MRI	magnetic resonance imaging
ML	Machine Learning
MLP	Multilayer perceptron
NB	Naive-Bayes
PCA	Principle Component Analysis
Phi	Phase
RGB	Red Green Blue
RBENN	radial foundation extract neural network
SOFM	Self-Organized feature Map
SVM	Support Vector Machine
SWT	Stationary Wavelet Transform

Chapter 1

Introduction