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ANALYZING INTERNET ADVERTISEMENT VISUALS USING GROUPING TECHNIQUES

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ABSTRACT

Digital marketing is a vast and swiftly expanding sector in contemporary society. One prevalent aspect of digital marketing involves the utilization of visual advertisements. Each time a user encounters an advertisement, a swift decision is made, often in real-time, to determine the most suitable ad for display. As a result, numerous algorithms have been devised to ascertain the optimal ad to present to the current user at any given moment. Typically, these algorithms focus on variations of the ad, optimizing different attributes such as background hue, image dimensions, or the array of images, yet none specifically define the characteristics of objects within the ad. Our research delves into new attributes of advertisements that can be discerned prior to display (as opposed to real-time optimization) and defines which objects within an ad image are most likely to yield success. We introduce a series of algorithms that employ machine learning to delve into digital marketing and to formulate object detection models capable of predicting the objects likely to appear in subsequent ad images. The primary aim of our findings is to achieve a high success rate in ad images containing specific objects. In this paper, we present and compare two methodologies: one employing a cascading trainer and the other utilizing an R-CNN network. We assess these approaches using HOG and CNN features, with the R-CNN method yielding superior results albeit requiring a longer training period.

1. INTRODUCTION

Digital advertising stands as one of the most expansive realms within the advertising sphere globally, experiencing rapid growth in recent times. Modern investors exhibit a strong preference for online platforms for their advertising endeavors. According to ComScore, a staggering 5.3 trillion display ads inundated the U.S. market in 2012 alone. Projections from Magna Global indicate that online ad revenue will soar to $72 billion by 2017. A prominent format within online advertising is web banners, also known as banner ads, seamlessly integrated into web pages as static images. Forecasts from Forrester suggest that by 2019, U.S. advertisers will allocate over $100 billion towards digital advertising, surpassing TV advertising expenditures at $90 billion. Web banners, designed to captivate and entice audiences, play a crucial role in driving website promotion and engagement through ad interactions and subsequent redirects to promoted websites.

Within ad images, a plethora of objects and content contribute to conveying promotional messages. Leveraging this content, we propose a methodology focusing on various detection methods like cascading detectors and RCNN for object recognition, complemented by color-based techniques for object attribute extraction. This approach aims to identify the most prevalent objects along with their distinguishing properties within ad images.

2. LITERATURE STUDY

Fire and Schler [1]: This study delves deep into the realm of online advertising by employing advanced convolutional neural network techniques to analyze ad images. Their research aims to enhance understanding and optimize strategies for digital marketers in the ever-evolving online advertising landscape.

Choudhury et al. [2]: Through the utilization of Haar feature-based classifiers, this paper focuses on the crucial task of vehicle detection, showcasing the practical applications of machine learning in automated systems. Their work contributes to advancements in transportation safety and surveillance technologies.

Ulfa and Widyantoro [3]: By implementing Haar cascade classifiers tailored for motorcycle detection, this research addresses specific challenges in object recognition, highlighting the adaptability and versatility of Haar-based methodologies. Their findings have implications in various industries, including security and traffic management.

Setjo et al. [4]: This study explores the realm of thermal image human detection using Haar cascade classifiers, emphasizing the importance of robust object detection techniques in specialized domains. Their work contributes to advancements in thermal imaging technology and human-centric applications, such as search and rescue operations.

Gavrilescu et al. [5]: The proposed Faster R-CNN method presented in this paper offers a significant advancement in real-time object detection capabilities. By combining speed and accuracy, this approach has implications for various applications, from surveillance systems to autonomous vehicles, contributing to advancements in computer vision technologies.

Yanagisawa et al. [6]: This study focuses on object detection methods specifically tailored for manga images using convolutional neural networks (CNNs). By leveraging CNNs, the research aims to improve the accuracy and efficiency of object recognition in unique visual content, such as comic book illustrations, expanding the scope of image recognition technologies.

Hsu et al. [7]: The development of a simplified Fast R-CNN for vehicle detection presented in this paper addresses the need for efficient and accurate object detection in dynamic environments. This approach streamlines the detection process, making it applicable to real-world scenarios such as traffic monitoring and autonomous driving systems.

Shaik et al. [8]: This comparative study on skin color detection and segmentation in different color spaces, namely HSV and YCbCr, offers insights into color-based feature extraction methods. The findings contribute to the field of image processing and content-based retrieval, with implications for applications in healthcare, surveillance, and image analysis.

MathWork [9]: The documentation provided by MathWork offers insights into the implementation of cascade object detectors, a fundamental component in object detection systems. This resource serves as a valuable guide for researchers and practitioners working in computer vision and machine learning domains.

MathWork [10]: The resources and tools offered by MathWork for deep learning in MATLAB provide researchers and developers with a comprehensive platform for exploring and implementing deep learning algorithms. This supports advancements in artificial intelligence and pattern recognition research.

Color Model Theory [11]: This resource provides a theoretical understanding of color models, particularly the HSV color model, which is widely used in image processing and computer vision applications. Understanding color models is essential for accurate color-based feature extraction and analysis.

HSV Model Wikipedia [12]: The Wikipedia page on the HSV color model offers a comprehensive overview of its components and applications. Researchers and practitioners can refer to this resource for a deeper understanding of color representation and manipulation in digital images.

Lee et al. [13]: This study focuses on object detection with sliding windows in images containing multiple similar objects, addressing challenges in accurate localization and recognition. The research contributes to advancements in object detection algorithms for complex visual scenes.

Meera and Shajee [14]: The work on object recognition in images presented in this paper explores various techniques and methodologies for accurate and efficient object detection and classification. Their findings contribute to the broader field of image recognition and pattern analysis.

Koo and Cha [15]: This study highlights image recognition performance enhancements through image normalization techniques, emphasizing the importance of preprocessing steps in improving recognition accuracy and robustness.

Csurka et al. [16]: The research on visual categorization with bags of keypoints provides insights into feature extraction and representation methods for image categorization tasks. This approach has implications for image retrieval, object recognition, and scene understanding.

Tham et al. [17]: The study on depth image object recognition using moment invariants focuses on leveraging depth information for accurate object recognition. Their work contributes to advancements in 3D imaging and object detection technologies.

Gautam et al. [18]: The concept of object recognition discussed in this paper offers a foundational understanding of the principles and methodologies involved in recognizing objects in digital images, serving as a guide for researchers and practitioners in computer vision.

Srivastava et al. [19]: This review on color feature extraction methods for content-based image retrieval provides a comprehensive overview of techniques and algorithms for extracting meaningful features from color information. The findings have applications in image search engines, multimedia databases, and content-based image retrieval systems.

3. METHODOLOGY

3.1 CascadeObject Detection.

Those vision.CascadeObjectDetector framework article goes for a few trained classifiers to identifying frontal face, upper body parts and the uppermost body. However, these classifiers are not generally worthy to A specific requisition. Computer vision Sytem Toolbox™ gives those trainCascadeObjectDetector function to prepare a custom classifier [9]. Cascading is a special case of ensemble learning based on the chain of several classifiers, using all data collected from the output from a given classifier as extra information for the next classifier in the cascade[16,18].

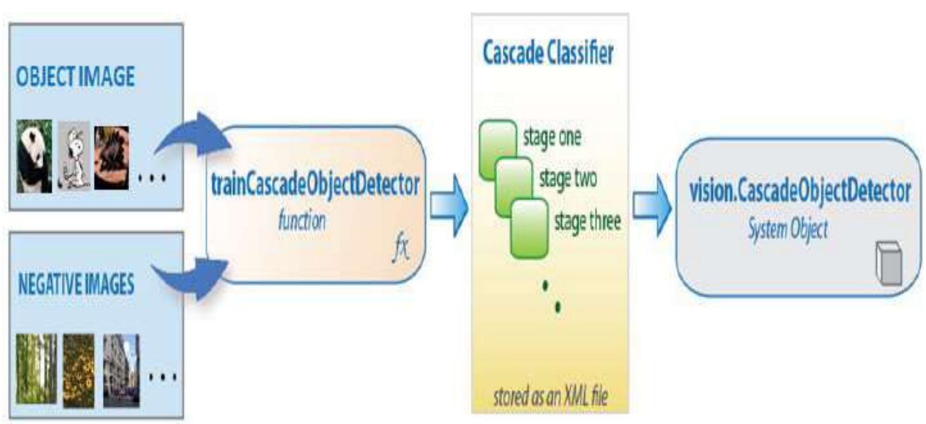

Figure 1. Cascade object detection work process.

3.2 RCNN.

Deep learning in utilization neural networks to gain advantageous representations of specification straight from dataset [10]. Neural networks blend different nonlinear processing layers, utilizing basic components working in parallel and supported toward biological apprehensive systems. Deep learning models[15] might accomplish state-of-the-art effectiveness for object classification, here and there surpassing human-level execution. You train models utilizing an expansive situated for marked dataset What's more neural system architectures that hold a number of layers, generally including A percentage convolutional layers [13]. Preparation these models is computationally escalated consideration Furthermore you might normally speedup the training by using a highly compatible GPU. The figure demonstrates how convolutional neural networks link layers that naturally figure out Characteristics from large portions pictures to arrange new pictures.

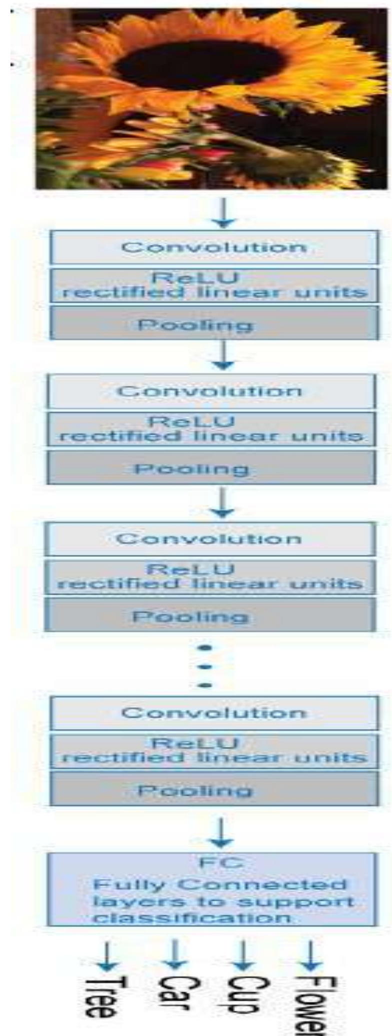

Figure 2. CNN Workflow

Many deep learning applications use image files, and sometimes millions of image files. To access many image files for deep learning efficiently, MATLAB provides the imageDatastore function [14]. Use this function to: Automatically read batches of images for faster processing in machine learning and computer vision applications.

Import data from image collections that are too large to fit in memory. Label your image data automatically based on folder names.

3.3 Color Detection

An alternate approach on describesa shade will be As far as those HSV model. The Hue(H) of a shade alludes will which accurate shade it resembles [11]. Every bit tint, tones Also shades of red have the equivalent hue. Hues are depicted Toward An amount that specifies the spot of the comparing immaculate shade on the color chart, similarly as A feature the middle of Zero and One. Esteem Zero call attention on all the on red; 1:6 is yellow; 1:3 may be green; thus, from every side of those color diagram. Those immersion (S) of a shade portray how white the shade might make. An perfect red is fully saturated, added an immersion of 1; tints for red kept saturations below 1; Furthermore white need an immersion about 0. Those quality (V) of a color, also known as its lightness, depicts how dull the shade may be. An esteem from claiming 0 will be black, with expanding softness moving away starting with black. The figure, named by the single-hexcone model for color cosmos, could assist you to dream up those intending of the Hue, Saturation, furthermore lightness parameters.

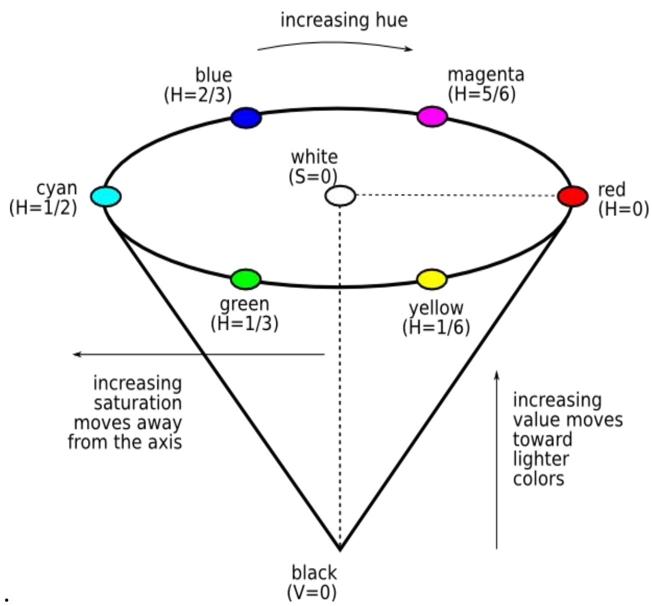

Figure 3. single-hexcone model of color space

The outer side of the greatest priority on the diagram is those color role, tougher by every one of immaculate shades. The H parameter portrays the plot in the whole wheel. Those s (saturation) may be zero to whatever color on the hub of the cone; those focal point of the highest point circissiliquastrum is white [12]. A increment in the worth about s corresponds will an produce faraway from the network. The v (value alternately lightness) is 0 for dark. An growth in the worth about v compare to a production out since bootleg What's more at the highest priority on those cone.

To settle on our definitions less demanding with write, we'll define these max and min, What's more Chroma part qualities Similarly as J, j, Also K, individually.

$$J = max(R,G,B)$$
$$j = min(R,G,B)$$
$$C = J - j$$

Those Hue will be the limit of the territory around those end line of the six sided polygon which permits through the computed location, initially calculated on the extent [Zero, One] Anyhow currently usually calculated On degrees [0°, 360degree] for keeps tabs that errand on the individuals origin in the chromaticity state (i. color between black and white), hue may be not computed [17].

$$H' = \begin{cases} undefined, & if K = 0 \\ \frac{G-B}{K} \bmod 6, & if J = R \\ \frac{B-R}{K} + 2, & if J = G \\ \frac{R-G}{K} + 4, & if J = B \end{cases}$$

The HSL and HSV models arrangement the bloom so those are consistently round up into the ambit [0, 1] for all possible aggregate of hue and illumination or worth, bring the new aspect assimilation from all possibility

$$S_{HSV} = \begin{cases} 0, & if V = 0 \\ \frac{K}{V} & otherwise \end{cases}$$

4. Proposed System

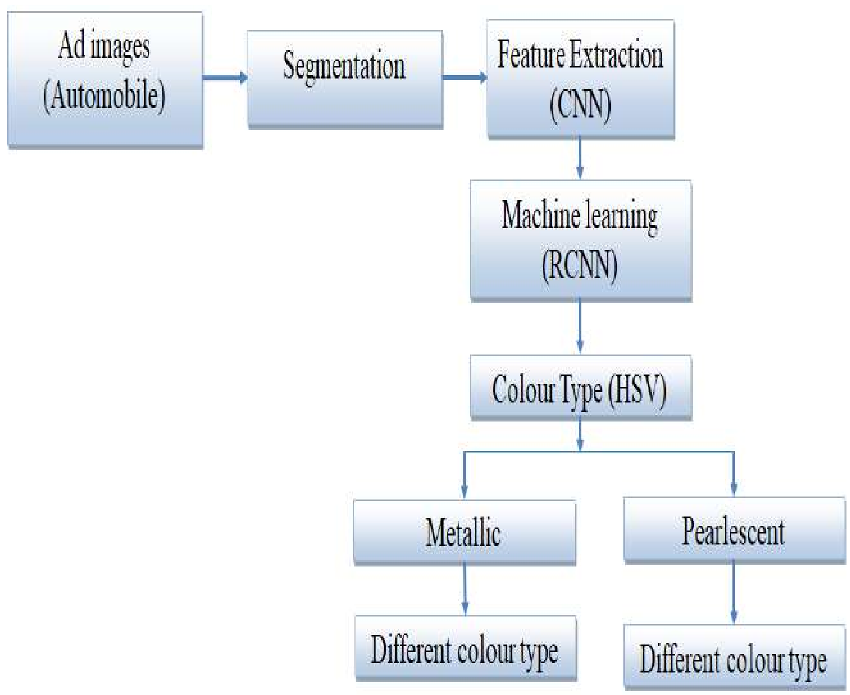

Figure 4. Proposed Approach Block Diagram

Upper diagram shows the flow diagram of our system that we presented. Here we first select the image as object and train the system, then we apply detection on the ad image. After detection we apply segmentation in that image and select the detected part. Here we apply the CNN classifier. After this step we apply color extraction method, here we use HSV color model for property extraction of detected object. Then we select most common appeared property of object [19]."

5. Results Analysis

Figure 5. Detector Results

Figure 6. Cascading Detector For 16 Automobile Adz Images

Figure 7. RCNN Detector for 16 Automobile Adz Images

Table 1 Analysis

Method	Accuracy	Time
Cascading	81.25%	0.27sec
RCNN	100%	26.57sec

6. CONCLUSION

Based on our findings in exploring ad images, a significant advantage lies in achieving superior recognition accuracy through the utilization of depth information coupled with extensive dataset training and machine learning techniques. Our research demonstrates the effectiveness of various detection methods alongside their respective features in obtaining accurate results. However, it is worth noting that certain methods may not be universally applicable across all features or objects.

The proposed approach in our work incorporates data based on content using the RCNN classifier for object detection. The RCNN classifier showcases a remarkable 100% success rate. Nevertheless, it is essential to acknowledge that there may be a computational delay associated with recognizing depth image objects, contributing to the complexity of the computational process. This emphasizes the trade-off between accuracy and computational efficiency, highlighting avenues for further refinement and optimization in future research endeavors.

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