Image Identification Using Machine Learning

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ABSTRACT

The field of computer vision has developed several methods of detecting contiguous circular pixel areas, or blobs. While both blob detection and computer vision are both still in their infancy, they are already being used in a variety of applications with significant successes. This study examined the effectiveness of classification-based machine learning algorithims on blobs and compared several models with a baseline to measure their performance. The system's objective was to take an image of a golf course as input and output the location of a golf ball in the image, if one is detected. The system took a raw image file as input, scanned it for blobs using image processing software, and then classified each blob as positive or negative as output. Results showed that several classification models, especially tree-based models such as Random Forest, could be used to classify blobs with statistically significant success.

INTRODUCTION

Computer vision is a broad field that is closely related to multiple sceintific fields such as mathematics, big data, and machine learning. Currently, computer vision is being used with marked success for applications such as facial recognition software and self-driving car operating systems. Blob detection is a specific field in image identification that focuses on identifying circular shapes in an image that have a definable edge and contiguous color. Machine learning can be used to classify blobs according to their features such as size and color. This project aimed to combine blob detection and machine learning by finding blobs in an input image and classifying each blob based on specific traits. The overarching goal is to use these findings to create a mobile application that can detect a golf ball sitting in the grass using a raw image taken by the golfer.

DATA AND SOFTWARE

- Flickr was used as the data source for pictures of golf balls and golf courses
- Scikit-Image was used for blob detection
- Scrapy, PIL, and numpy were used to extract features from each image
- After feature extraction, images were written in the ARFF format so that the machine learning suite weka could classify and predict each instance
- A total of 153 instances were manually classified and prepared for training so that ten-fold cross validation could be used

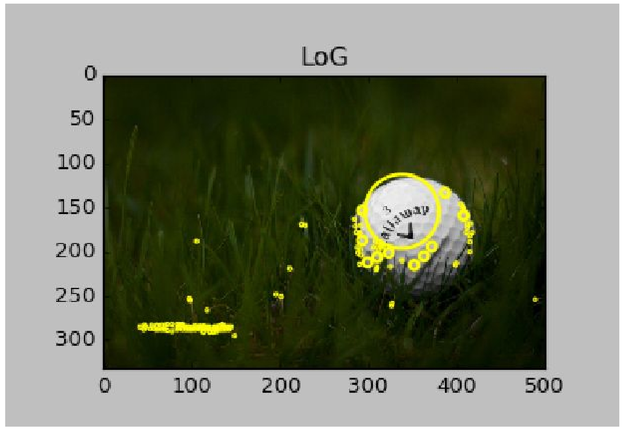
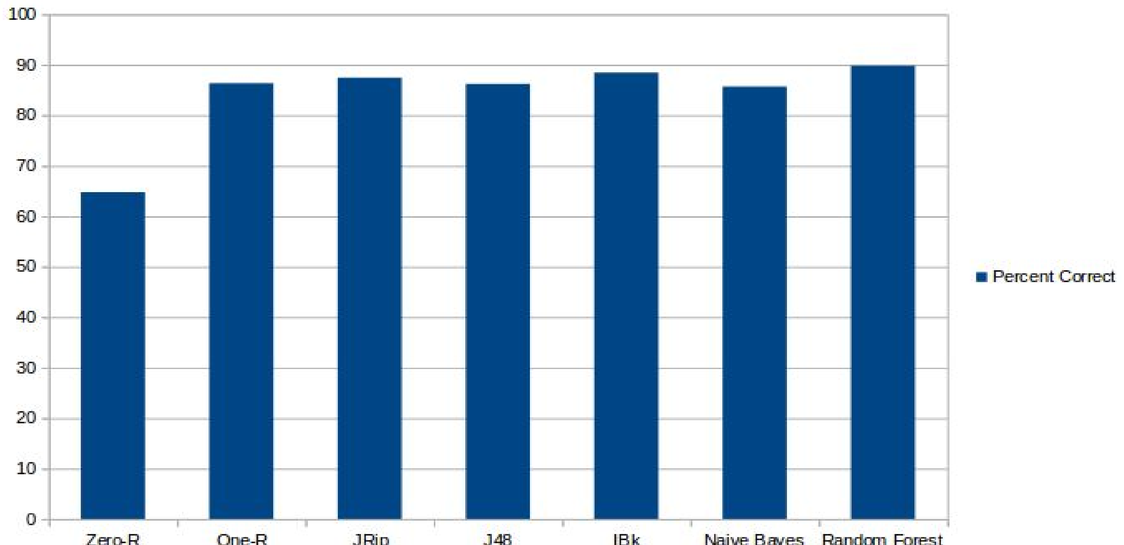


Figure 1. Sample image with deteced blobs shown

Results

- Results found that classifcation-based models have a statistically significant effect when combined with blob detection
- Zero-R was used to establish a baseline on which other algorithms were compared
- Random Forest was found to be the most accurate algorithm with 89.9% accuracy
- Naive Bayes performed the worst, with 85.68% accuracy



System Process

1. Flickr API queried by spider
2. Image is downloaded
3. Blobs are detected from image using Laplacian of Gaussian
4. Candidate blobs are recorded then scanned for features
5. Features are recorded in ARFF file
6. Data is fed to machine learning software to classify, predict, and analyze results

REFERENCES

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