

AI Skunkworks Project

Object Recognition using Capsule Networks

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Start Date: 8th March 2019

Project Duration: 90 days (For Spring 2019 students who need to submit a project, the deadline for tasks will be course project deadline)

Abstract:

Convolutional Neural Networks (CNNs) having been successful in solving the real world problems of object recognition and classification, and are repeatedly implemented to recognize objects in recent years. However, CNNs have a hard time classifying images if the relative position of elements in the image are changed spatially by adding a rotation factor or a revolutionary view of the image. This is due to the fact that the CNNs involve a max-pooling layer which takes away a lot of important information away since we are reducing the image dimensions and keeping only locally important features. So while the images retain the information likes edges, colors, depth etc in different layers, it fails to capture the positional and relative locations of these features with respect to the entire image. This drawback is addressed by capsule networks. Capsule Networks will help in maintaining these positional variances while increasing the classification accuracy of the system. Basically, you need not train the system with all possible positional combinations of images, rather a small set of dataset is enough for training and capturing the variances of position and alignments in space of these objects. Capsule networks are claimed to be better in object detection and classification and we are trying to verify this claim while simultaneously experimenting if the networks themselves can be enhanced further by using ensemble of image filters.

Deliverables:

1. Build a 3D image dataset of 60 monuments using MAYA
2. Design and Build a base model architecture using convolutional neural network for comparison
3. Design and implement capsule network model on the same dataset for initial comparison.
4. Tune the hyperparameters of the designed model to produce accurate result and reduce overfitting (if present)
5. Find out ways to improve the base model of Capsule Networks.

Prerequisites:

Please contact Project Manager

Milestones:

No	Tasks	No of people	Due Date
1	Category 1: Dataset of Monuments a) Each student should select 3 Monuments b) Create 3D images using Maya c) Each Monument should be a category and contain 1000 images d) Upload to the Database	6 students each doing everything from task a to d in order and sequence	Task a,b,c: April 10, 2019. at least 20 images per monument with 3 monuments per student. Write Maya scripts under Prof. Nick's guidance and replicate the scripts on the other monuments. Task d: April 20, 2019. Students should come up a conceptual schema of the database while creating more images of monuments.
2	Category 2: CNN a) Reading and separating existing images from folders b) Apply filters to the model (2) c) Record the accuracy for each filter (1) d) Build a basic model for CNN e) Find best hyperparameter and architecture for CNN	1 student for directory and image reading, 1 student for applying filters on images and 1 student for working on CNN and it's architecture	Task a: March 24,, 2019 Task b: April 5, 2019 Task c: April 5, 2019 Task d,e: April 10,, 2019
3	Category 3: Google Cloud Platform(GCP): a) Deploy sample project to GCP b) Load Dataset to the GCP c) Creating a instance in GCP to perform ML tasks d) Deploy the base CNN model in GCP e) Deploy the CNN with best hyperparameters in GCP	1 student doing tasks a, b and c, 1 student doing tasks d and e	Task a: March 30, 2019 Task b: April 2, 2019 Task c: April 7, 2019 Task d: April 1, 2019 Task e: April 9, 2019