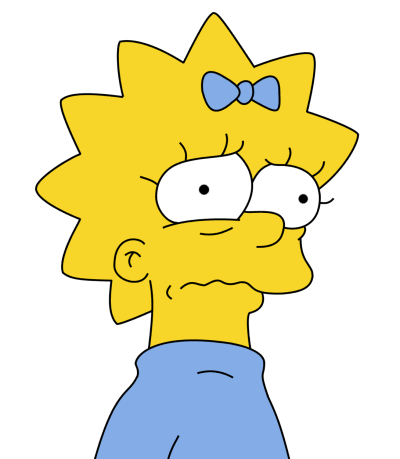
**Image Detection – Simpson's characters**

**Assignment 2 - Problem Definition - Sprint 1**

**Interesting inspiration**

Can you tell the difference between Maggie Simpson and Lisa Simpson? Was that Lenny Leonard or was that Carl Carlson?

**Problem Definition**

* We want to classify Simpson characters from images and from videos.
* We also want to extend this functionality when we have multiple characters in an image.
* We should be able to recognize each individual character and draw bounding box around each.
* We need to have good interface to perform the classification.

**Additional information about the Problem**

Simpson is a very popular cartoon and our team was interested in working on an image analytics related project. On seeing the Kaggle dataset related to image detection of Simpson’s characters (as proposed in the Suggested Projects by our Professor), our team decided to work on this. The image dataset available on Kaggle.com has 20 folders (one for each Simpson character) with 400-2000 pictures in each folder. This image dataset is a collection of video frame captures from Simpson’s episodes. Dataset includes images that feature multiple characters in a single frame. We would like to build a model to distinguish between Simpson characters.

**Scope**

**Architectures for Image detection and Image classification**

|  |  |
| --- | --- |
| **Problem** | **We can explore below architectures** |
| Image Classification | 1. CNN 2. Hybrid CNN-ELM - Image Classification 3. Mask R-CNN - Image Segmentation |
| Object detection | 1. Faster R-CNN with different Hyper parameter 2. YOLO (You only look once) 3. SSD (Single shot Multi-box detection) |

**Stretch Scope:**

* Building UI or Visualization
* Standardized Framework to support any image classification/object detection use case
* Ability to identify Simpson’s characters in a video at pre-defined intervals.
* Explore use of Cloud Computing

**Data Source**

**Data for Core Image Classification and Object Detection**

* 400-2000 images for 20 characters from the Simpsons cartoon series
* Images are of various sizes, from different scenes and extracted from episodes (season 4 -24).
* Images could have multiple characters, with subject character being the primary one or centered in an image
* Existing data suffices for all identified algorithms but may not work as is for Mask R-CNN algorithm.

**Data for Stretch scope**

* May require additional datasets to build the standardized framework. Team plans to research this in a later Sprint (post Sprint 3)

**Other Datasets:**

* There may be insufficient images with multiple characters for tagging. This may require the team to generate additional frames with multiple characters.

**Technology and Tools**

Repository:

GitHub, Github Desktop, OneDrive, GitLab

Development tool:

Jupyter notebook

Compute:

Argo, AWS

Primary Development Language:

Python 3.7.2

ML Libraries:

Tensorflow, Keras, PyTorch (could include others)

Agile board:

YouTrack

Collaboration tools:

Blackboard, Slack, What’sApp Web

Others:

Explore SSD MobileNet for a live demo.

UI framework – JavaScript Libraries (TBD)

**Assumptions:**

* Images in the dataset are distinct enough to train an image recognition model.
* Number of images for each dataset meet the minimal threshold to train a model that can predict with good accuracy.

**Risks:**

* Computing power required to run image detection code can be high. Risk of programs taking too long to run is possible. This may impact the amount of time the team has to test and implement.

Possible mitigation for this risk would be to use GMU’s Argo cluster.

* Scope includes a few aspirational items, completing of which will be directly dependent on available time.

Prioritization of tasks and communication with team/professors could help mitigate this risk.

**References:**

* Shoji Kido; Yasusi Hirano; Noriaki Hashimoto Detection and classification of lung abnormalities by use of convolutional neural network (CNN) and regions with CNN features (R-CNN) <https://ieeexplore.ieee.org/document/8369798>
* Suresh Prasad Kannojia; Gaurav Jaiswal Ensemble of Hybrid CNN-ELM Model for Image Classification <https://ieeexplore.ieee.org/document/8474196>
* Faster R-CNN Shaoqing Ren, Kaiming He, Ross Girshick, Jian Sun <https://arxiv.org/abs/1506.01497>

**Lexicon:**

* Provide a list of your initial terms and definitions. (vocabulary)