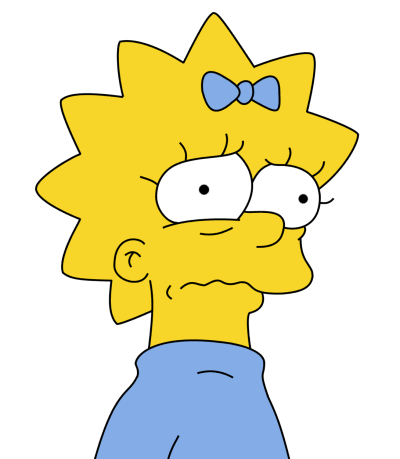
Image Detection – Simpson's characters

### Assignment 1 - Problem Definition - Mid 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**

Initial Story - 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.

**Data Source:**

* <https://www.kaggle.com/alexattia/the-simpsons-characters-dataset>

**Major Research Methods**

# Statistical:

Classification Techniques, Neural Networks – Convolutional Neural Networks, Faster R-CNN

# Model Development:

Libraries like Keras, Tensorflow. Tools like Jupyter notebooks, Github.

**Scope** (includes aspirational items)

* Data preparation including data cleaning and preprocessing
* Explore Classification techniques for image classification using Neural Network algorithm techniques like CNN.
* Use techniques like Faster R-CNN, Hybrid CNN for image tagging in multiple character per frame scenarios.
* Include Visualization of model performance metrics.
* Build a UI to execute the model and perform Simpson character detection/classification.
* Explore creation of a generalized framework that can support any image classification/detection use case.
* Explore ability to identify Simpson’s characters in a video at predefined intervals.
* Explore use of open source tools and libraries like Github, Jupyter notebook, Keras, Tensorflow to aid development of image detection model.
* Explore use of Cloud Computing, specifically, AWS Sagemaker to aid in development of ML model. There are costs associated with using AWS and team will determine if the AWS Educate credits will suffice in covering any costs.

**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>

**Other datasets:**

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

**Lexicon:**

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