Image Segmentation

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# Domain and Background

As a human, we are very good at analyzing the scene/image we see. We can easily recognize the different things and objects we see. Our brain is very good at differentiating one object from another for example we can easily differentiate persons available in one photograph. But it was very difficult for machines to do these things some years back. With the advancements in computer vision, machines have become good at analyzing images. Now we can build machine learning models that can detect different objects in images. The same technology is being used for self-driving cars, different tumor detections in the humon body. It can also help in differentiating malignant and non-malignant tumors. Image segmentation is considered the most important medical imaging process as it isolates the region of interest (ROI). Image segmentation is the process of partitioning or dividing the digital image into different segments depending on the objects or types of objects present in the image. Image segmentation simplifies the image by removing the unwanted data or data that is not of interest from the image. This simplification then helps in analyzing the region of interest. With this project, I will be implementing a machine learning model by using neural nets to segment different objects present in images,

**References:**

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[4] Image segmentation - <https://www.tensorflow.org/tutorials/images/segmentation>

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[6] U-net segmentation – Yuanfan You - <https://www.kaggle.com/yuanfanyou/u-net-segmentation>

[7] Visual Object Classes Challenge 2012 (VOC2012) – Pascal 2 - [http://host.robots.ox.ac.uk/pascal/VOC/voc2012/#data](http://host.robots.ox.ac.uk/pascal/VOC/voc2012/" \l "data)

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[9] Tutorial 3: Image Segmentation - <https://ai.stanford.edu/~syyeung/cvweb/tutorial3.html>

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# Data Understanding

The dataset is made available by Pascal 2(Pattern Analysis, Statistical Modeling, and Computational learning) at [http://host.robots.ox.ac.uk/pascal/VOC/voc2012/#data](http://host.robots.ox.ac.uk/pascal/VOC/voc2012/" \l "data). The dataset was made available as part of Visual Object Classes Challenge 2012 (VOC2012). This dataset contains images as training data and segmented images with outlined objects as labeled data. This dataset contains 2913 total images available. This dataset contains the following 20 object classes selected.

* Person: person
* Animal: bird, cat, cow, dog, horse, sheep
* Vehicle: airplane, bicycle, boat, bus, car, motorbike, train
* Indoor: bottle, chair, dining table, potted plant, sofa, tv/monitor

The segmented images are annotated with pixel-wise segmentation of each object present. Each object/class is annotated with a different color to denote a different object. The dataset is been split into a training dataset validation dataset.

# Research Questions:

With this machine learning model, I will try to detect the above-mentioned 20 objects in the image. After detection, we can easily isolate those objects from the original image. This model can be easily trained with different images to use with different applications. This particular model can be used in self-driving cars to detect different objects present on the road so that it can take different actions if required.

# Method:

I will be using augmentation to generate more images for training. This will also avoid the overfitting of models due to fewer images available. I will be using the neural net model of TensorFlow for this purpose. I will try to use a pre-trained model, this improves the accuracy of the model.

# Potential Issues:

Image data is always difficult to work with. As it cannot be analyzed by reading it. We need to work with mostly binary arrays. Most of the time the different sizes of the images and dimensions of these arrays create some complexities while working with this data. As the size of the data becomes huge while working with images, I might face some hardware limitation issues.

# Concluding Remarks:

Image segmentation can be useful in many applications like medical imaging, self-driving cars, traffic control systems, Locating objects in satellite images, etc. If the accuracy of these models is good it can save help lives in applications like self-driving cars and medical imaging.