CS 584 - MACHINE LEARNING

Topic:

Image Segmentation

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Description:

The task of semantic image segmentation is to order every pixel in the image. We can separate or segment the image into different parts called sections. It is anything but an extraordinary thought to handle the whole image simultaneously as there will be areas in the image which don't contain any data. By isolating the image into sections, we can utilize the significant portions for preparing the image. That, basically, is the way image division works.

An image is an assortment or set of various pixels. We group together the pixels that have comparable attributes utilizing image segmentation. Object detection tells whether an article is in the image or not. Yet, it reveals to us nothing about the state of the article. We just get the arrangement of pixels. We need to get more data – limited data is excessively unclear for our motivations and does not help in getting accurate models .

Image segmentation makes a pixel-wise segregation for each item in the image. This procedure gives us an undeniably more granular comprehension of the objects in the picture.

Applications:

1. **Medical Images** - Image segmentations can be used in the medical field to detect tumors and enhance results of diagnostic tests. *The shape of cancerous cells plays a vital role in determining the severity of the cancer.*
2. **Autonomous Vehicles** - Image segmentation can greatly enhance the performance and use of self-driving cars and drones.
3. **Satellite image analysis** - Image segmentation can allow us to segment different types of landscapes and generate maps.

Survey:

Image segmentation has a wide range of applications as we can see above and with these wide range of possibilities we want to explore and implement the various image segmentation techniques and algorithms. Whenever we work with the image in any application, the initial step is to separate the contents of the image in order to solve its complexity.[2]
After surveying a wide range of reviews, writings and pioneering works we get the similarity, strengths and challenges of deep learning models. We are able to examine various datasets, report performances and discuss future projects in this field.

Preliminary plan:

In order to build a successful image segmentation model we need to build two sub models which are:

1. **Region based segmentation:** One straightforward approach to segment various items could be to utilize their pixel values. A significant highlight note – the pixel values will be diverse for the items and the image's background if there's a sharp difference between them. For this situation, we can set a threshold value. The pixel values falling underneath or over that threshold can be arranged appropriately (as an item or the foundation). This method is known as **Threshold Segmentation**. The benefit of this strategy is that it is straightforward, quick and has high accuracy when the article and foundation have high differentiation.
2. **Edge Detection Segmentation:** There is consistently an edge between two nearby regions with various pixel values. The edges can be considered as the discontinuous local feature of an image. We can utilize this discontinuity to recognize edges and subsequently characterize a limit of the object. This encourages us in recognizing the shapes of numerous objects present in a given image. To recognize these edges we utilize filters and convolutions.

Milestones :

Proposed Task	**Estimated Date of Completion**
Region Based Segmentation Model	March 15, 2021
Edge Detection Segmentation	March 31, 2021
Mask R-CNN Model	April 22, 2021
Project Completion	May 1, 2021

Languages, Platform and Libraries to be used:

1. Programming Language - Python
2. Packages and Models - Keras, PyTorch, Tensorflow
3. **Mask R-CNN -** We propose to use Mask R-CNN which is widely used in object detection tasks.We present a conceptually simple, flexible, and general framework for object instance segmentation. Our methodology productively identifies objects in a picture while at the same time creating a great division for segmentation for each instance.

Mask R-CNN has a two-stage procedure, with an indistinguishable first stage (which is RPN). In the subsequent stage, in parallel to predicting the class and box offset, Mask R-CNN also yields a binary mask for each RoI. This is in contrast to most recent systems, where classification relies on mask predictions.

References:

1. http://cs229.stanford.edu/proj2016/report/GongHeYang-Real-time%20Object%20Detection-report.pdf
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