Automatic Segmentation of Satellite images

There is an increasing amount of data flow from high quality satellite images, and earlier methods used manual labor for segmenting regions for classifying features and unique entities. From the recent trend in Deep Learning (DL) techniques and the use of Convolutional Neural Networks [1, 2], it has been easy for machines to classify, segment and extract features from images in a scalable way. Still there remains challenges in verifying whether the results are valid or not by human agents.

The main aim of the research will be to create an algorithm using DL techniques which will reduce the problem of creating labeled dataset for feeding into the DL model, rather will learn from the unlabeled data. There have been several related works in the field, some of which uses U-Net [3], unsupervised semantic parsing [4], and recurrent residual networks [5].

There are a lot of datasets available online, but I have already done the 5% work by creating a scraper which scraps high quality apple map, and open sourced the code in GitHub [6], for creation of custom datasets. One of the major drawbacks of Neural Networks is it needs lot of data, so some focus should be also towards one shot learning. The work could help in creating a mask over unknown and unlabeled areas to get a statistical overview of the area. This method can also be extended towards other satellite images (e.g., images from Mars) to get a general idea about the unknown environment. Automatic segmentation will also help to pinpoint areas of unusual anomalies, which means it may also extend to surveillance from satellite data. It is hard to get the source code, but not impossible, there are several of the open sourced repositories which covers some part of the project already.

This algorithm in general will be able to give overview of a lot of satellite images, number of unique classes present, and surveillance in general. Will also take part in SpaceNet 7: Multi-Temporal Urban Development Challenge (https://spacenet.ai/sn7-challenge/), and will see if we could do something out of it.

References:

1. Jimut Bahan Pal, “Deceiving Computers in Reverse Turing Test through Deep Learning”, Available at arXiv:2006.11373, cs.CV: https://arxiv.org/abs/2006.11373.
2. Jimut Bahan Pal, Shalabh Agarwal "Real Time Object Detection Can be Embedded on Low Powered Devices." *International Journal of Computer Sciences and Engineering* 7.2 (2019): 1005-1009.
3. Virginia Ng, Daniel Hofmann, “Scalable Feature Extraction with Aerial and Satellite Imagery, Scipy 2018, Available at: http://conference.scipy.org/proceedings/scipy2018/pdfs/virginia_ng.pdf.
4. Ilias Grinias, Costas Panagiotakis, Georgios Tziritas, “MRF-based segmentation and unsupervised classification for building and road detection in peri-urban areas of high-resolution satellite images”, ISPRS Journal of Photogrammetry and Remote Sensing, Volume 122, 2016, Pages 145-166, ISSN 0924-2716, Available at: https://doi.org/10.1016/j.isprsjprs.2016.10.010.
5. Chunping Qiu, Lichao Mou, Michael Schmitt, Xiao Xiang Zhu, “Local climate zone-based urban land cover classification from multi-seasonal Sentinel-2 images with a recurrent residual network”, ISPRS Journal of Photogrammetry and Remote Sensing, Volume 154, 2019, Pages 151-162, ISSN 0924-2716, Available at: https://doi.org/10.1016/j.isprsjprs.2019.05.004.

6. Jimut Bahan Pal, “API to get enormous amount of high-resolution satellite images from apple maps quickly through multi-threading”, Available at: https://github.com/Jimut123/jimutmap.