Neural Networks

Project Proposal - *Cloud type segmentation CNN*

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GitHub repo: https://github.com/tomasMizera/nsiete-project

1. Motivation

In this project we will try to segment cloud satellite pictures and recognize different types of clouds in them. There are 4 major cloud types - Fish, Gravel, Sugar and Flower[2]. The goal of this project is to automatize process of cloud types detection since it can help scientists to build greater environmental models that helps to predict future climate changes.

[1] mentions that:
There are many ways in which clouds can organize, but the boundaries between different forms of organization are murky. This makes it challenging to build traditional rule-based algorithms to separate cloud features.
Therefore there is a movement trying to classify clouds via Neural Networks.

2. Related Work

Original idea comes from this Kaggle competition[1] (*still opened*) where *Max Planck Institute for Meteorology*. Competition's goal is to recognize different cloud types on provided test data. There are also included example `jupyter notebooks` with data loading and processing that can help us get started. Moreover, there are several notebooks that

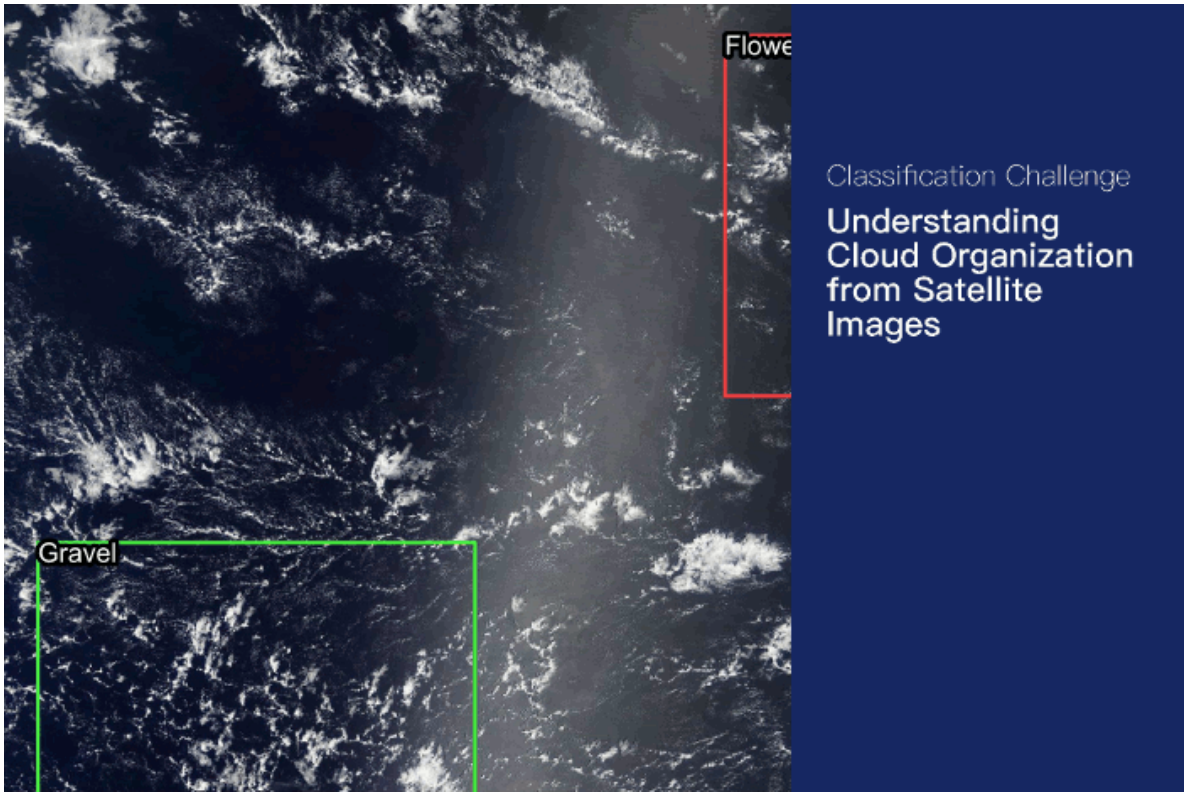
Further we provide a list of related works that could help us getting started or gain additional information in the weather area:

- Scientific paper *Combining crowd-sourcing and deep learning to understand meso-scale organization of shallow convection*[2],
- Thesis written by Adam Rafajdus[3] that tries to predict weather based on multiple weather factors, including cloud movements.

3. Datasets

Our dataset consists of train and test images downloaded from Nasa Worldview. Data was labeled by a team of of 68 scientists. There are 4 label names: Fish, Flower, Gravel, Sugar. And result value is 4 image masks, one for occurrence of each type of cloud. In total we have 5546 images in train dataset and 3698 images in test dataset.

Here is a visualized example from labeled train data:



4. High-Level Solution Proposal

As far as we are currently concerned, we will use Mask R-CNN networks with a specific architecture that will be chosen based on discussions. Most probably we will use one of those architectures: *VGG*, *Inception*, *ResNet or Dense* Net.

Literature

[1] Understanding cloud organization, Kaggle competition by Max Planck Institute for Meteorology

[2] *Combining crowd-sourcing and deep learning to understand meso-scale organization of shallow convection*, Rasp Stephan et al., 2019

[3] Weather Forecast by Generative Adversarial Networks, Adam Rafajdus, 2018, Thesis at Faculty of Informatics and Information Technologies STU.