Google Earth and K-Means: Exploring Urban and Natural Dynamics

AI Research Proposal

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Abstract

In the following study, we will use information extracted from Google Earth Engine to observe and analyze the change of the terrain over time in different contexts and landscapes. For this purpose, we will work with unsupervised classification methods that guarantee an optimal and efficient performance when classifying images. In particular, clustering techniques will be used, algorithms whose main function is to find groups of pixels with similar characteristics, grouping them according to these properties. All of this will be implemented using Google Colab, where, in addition, a previous training of the algorithm will be required for its correct operation. Finally, the implemented code will be tested in different cases to analyze the results and its behavior.

Aim

This study aims to measure the temporal evolution of urban dynamics within the city of Madrid and other remarkable environments (e.g. the Aneto glacier or Benidorm beaches). The focus includes quantifying the changes in vegetation within parks and the urban expansion, or the reduction of ice mass or the increase of tourist density. To accomplish this objective, Google Earth Engine will be employed, offering access to multi-decadal satellite imagery covering spans of up to 40 years across various geographic regions. The analysis will employ an unsupervised classification approach, utilizing clustering techniques, particularly the K-means algorithm.

Objectives

To achieve the aim of this project, it is necessary to break it down into objectives, each of which will further be subdivided into tasks or small work packages. The primary objectives can be summarized as follows:

- Theoretical basis of unsupervised classification using K-means (length: 2 pages).
- Concise review of K-means clustering in environmental dynamics (length 1 page).
- Study scenarios - Madrid (growth, density, vegetation), Aneto glacier, Benidorm beaches (length: 3 pages).
- Implement K-means using Google Colab.
- Train the algorithm using Google Earth Engine.
- Document the implementation process (length: 3 pages).
- Quantify dynamics in chosen scenarios.
- Compile results and draw conclusions (length: 4 pages.

This division will be roughly followed in the final report.