Whitewater Difficulty Classification via Satellite Images

Scope & Target

One-liner description: develop a system to automatically identify the whitewater difficulty of rivers based on satellite images.
Target: D, DV and IT students.

Project description

Background: Machine-learning has undoubtedly seen huge improvements in the last decades. A type of data that has gain popularity is satellite images, which have become more precise and as the same time more open. For example, among works that use satellite images, one can infer for example roof top panels and swimming pools (the tax agencies are pretty happy about that one) but also poverty level or crop types. Beyond the amateur casual kayaker that would be glad to have an automatic tool to know the difficulty of river sections, you can imagine that such a system could also be useful for emergency services or rescue missions to know how easy it is to navigate certain remote and poorly documented sections.

Goal for the project: This is mainly a fun project intended for the group to learn, practice and adapt popular Machine Learning models & tools with a concrete goal to try to reach at the end. Basically, the project is to learn about and manipulate: satellite images & basic image processing, ML and in particular CNN and possibly web frontend & web crawling.

Project's idea: A suggested workflow for this bachelor project would be to work on the following 3 tasks:

1. **Data Acquisition**. "Ground truth" data can be obtained from American Whitewater data, possibly by crawling the website. Also arcgis data could be used here.
2. **Machine Learning Training**. A CNN model can be trained using the acquired data through eg using Amazon Web Services (AWS). The machine learning approach can also be compared with a simple one based on basic image processing.
3. **Web Visualization**. Once a model has been built, a simple web visualization tool can be developed to display the results for eg Sweden (and this can be compared with data from *https://www.forsforaren.se*).

Outcome: Putting all the parts together, the output could be a working whitewater difficulty classification system but the project can also be driven by students' interests in exploring some aspects more in depth.

Suggested starting material

Some introductory websites with similar approaches:
- Identify rooftop solar panels from satellite imagery using Amazon Rekognition Custom Labels
- Applying machine learning algorithms to satellite imagery for agriculture applications

Links to open datasets that can be leveraged: here, there and there.

Starting scientific publication:
- Kadhim et al. "Convolutional neural network for satellite image classification." Asian Conference on Intelligent Information and Database Systems. Springer, Cham, 2019.

Special prerequisites

- Since we don't focus here on obtaining the best accuracy but rather developing a working proof-of-concept, there is no compulsory prior knowledge requirements.
- Previous experience with Machine Learning / AWS would be a plus.
- Also some previous knowledge in image processing can help.
- At last, an interest in kayaking / whitewater sports would also be a plus :)

Proposal author & Supervisor

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