# DSA Project

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## Warmup

Follow the instruction in this link and include the filled-in notebook, with the needed comments, in the project submission.

## Introduction

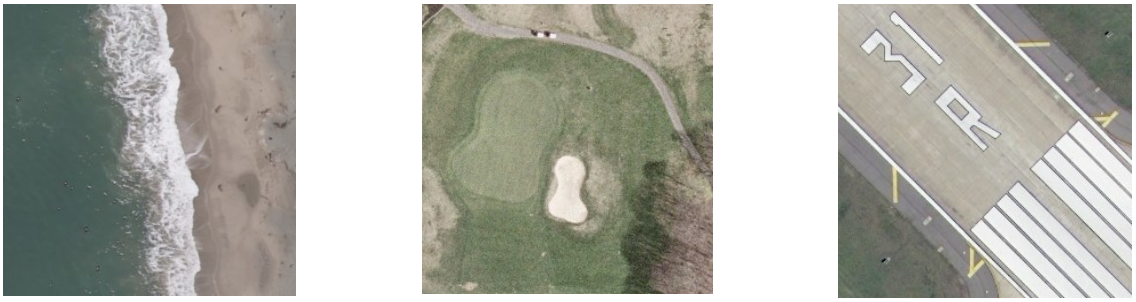
One of the main usages of remotely sensed imagery is to characterize land-use. As land-use is frequently changing, the acquisition of an important amount of overhead imagery represents an opportunity to follow this evolution. Since the amount of data to be processed is large, manual processing is hardly an option. Therefore, many studies have been dedicated to automatic land-use characterization from overhead imagery [1, 2]. In this project, you will study the feasibility of deep learning models for this.

## Data

### Single-label case

For this project, you will use the UCM Dataset [3], available here. This dataset contains 21 land-use classes (e.g. agricultural, tennis court, beach, …). Each of this classes are represented with 100 256*256 pixels high-resolution image (30 cm), such as shown in Fig. 1.

In the dataset that you will download, there is one folder for each class. Each folder contains 100 images encoded as TIFF.



beach Golf course Runway

Fig 1. Examples of images from the UCM Dataset

### Multi-label case

One obvious limitation of the UCM dataset is that an image might contain several land-use classes. To this effect, an extension of this dataset was proposed by the authors of [4]. They re-labeled the 2100 images of the UCM dataset to 17 classes in a multi-label setting (i.e. each image can have several labels), as shown in Fig. 2. The annotations are available here. The DSA Project Notebook provided includes code that downloads the data on Colab, so that you do not start from scratch!

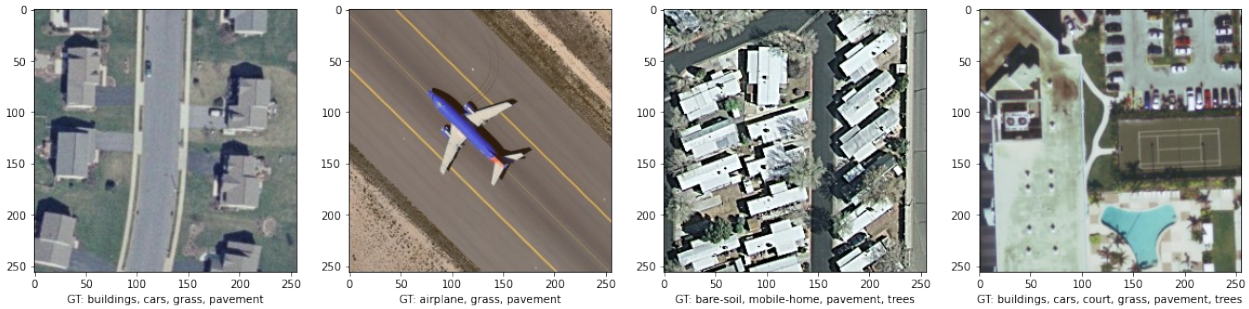



Fig 2. Examples of images from the UCM Dataset with multi-labels annotations

## Objectives of this project

For this project, you need to design and evaluate some methods to characterize land-use, using one the two proposed datasets (either single-label or multi-label). You are free to design the experiments and models. For instance, feel free to use the labels to train a model or use CLIP to do classification without labels. However, the final project report should contain a section justifying your choices and putting them in perspective with respect to what you have learned during the course. Besides designing a solution, make sure to put efforts on the evaluation (including comparison with different approaches).

## Specific instructions

- You can start by copying this Colab notebook to your Google Drive.
- You can use any code you find online, but it's best to start looking at the Pytorch docs.

## Evaluation

This project will be evaluated based on the report and the code. The code needs to be in *ipynb format, following the structure of the notebook given with this project. The report needs to be in PDF. Being able to train a CNN to classify the images with a good accuracy (at least around 80% on the test set for the single class setting) would be perfect, but do explain what you have tried and what has worked and what not. The limited amount of time available and the openness of the task will be taken into account in the evaluation. Send the report and code to Diego by email with the subject in the format: **[DSA Project] Name Surname**. Deadline: **October 6**$^{th}$.

## References

[1] Hu, F., Xia, G. S., Hu, J., & Zhang, L. (2015). Transferring deep convolutional neural networks for the scene classification of high-resolution remote sensing imagery. Remote Sensing, 7(11), 14680-14707.

[2] Zhu, X. X., Tuia, D., Mou, L., Xia, G. S., Zhang, L., Xu, F., & Fraundorfer, F. (2017). Deep learning in remote sensing: A comprehensive review and list of resources. IEEE Geoscience and Remote Sensing Magazine, 5(4), 8-36.

[3] Yang, Y., & Newsam, S. (2010). Bag-of-visual-words and spatial extensions for land-use classification. In Proceedings of the 18th SIGSPATIAL international conference on advances in geographic information systems (pp. 270-279).

[4] Chaudhuri, B., Demir, B., Chaudhuri, S., & Bruzzone, L. (2017). Multilabel remote sensing image retrieval using a semisupervised graph-theoretic method. IEEE Transactions on Geoscience and Remote Sensing, 56(2), 1144-1158.