**Project: city imaginary categorization**

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**Question to investigate**

The goal of this research is to evaluate how well cities/districts can be characterized by their visual properties by leveraging the readily available city imaginary data set provided by google street view.

What is the typical image of a city that makes it distinguishable from others? To what extent different areas within a city are visually consistent? How much visual similarity can we find across different cities? This project will take the first step to answer these questions by:

1. Training a deep learning neural network to categorize street view images from N different cities.
2. Investigating what features of an image determine it category through feature removal (explained below)

**Method**

We will use CNN for the categorization problem.

Once we have a reasonably good categorization algorithm, we try removing some features in some test images, and compare categorization accuracy before and after the removal.

* how to remove image features - quick and dirty way for color: color histogram matching. Pick some images that are categorized as category\_A, re-map their color histogram to match the average histogram of category\_B, and look at whether this would result in false categorization.
* maybe we can also do something similar to texture, shape etc, but by virtue of time we will only experiment with color first.

**Data**

Google street view images, api: <https://developers.google.com/maps/documentation/streetview/?hl=en>

Each image is naturally associated with a label (city name), because we know its coordinates when requesting it. We will choose from N visually different cities, and request images only from districts that are most (and most consistently) representative of that city.

**Most relevant readings**

1. Image features and their correlation with latent information in an urban setting: <https://people.csail.mit.edu/khosla/papers/cvpr2014_khosla.pdf>
2. Content categorization of geo-tagged images, and urban perception analysis via re-mapping: <http://people.csail.mit.edu/bzhou/project/eccv2014/ECCV14_cityperception.pdf>
3. Imagery features that define urban identity (*what makes paris look like paris*) <http://graphics.cs.cmu.edu/projects/whatMakesParis/>
4. Anatomy of CNN: <http://arxiv.org/pdf/1412.6856.pdf>

**Existing methods and their availability**

Existing methods for image categorization: mostly CNN, available.

Existing methods for understanding feature - meaning relationship of images include:

* SVR for correlating mid-level image features with latent contents (relevant reading 1)
* Looking at receptive fields in layers within CNN (relevant reading 4)

**Result evaluation**

Categorization accuracy; difference in categorization accuracy before and after feature removal

**Expected output (e.g. plots or figures)**

Mapping the categorization results back to their geospatial locations.