# Automatic Dwelling Detection

## 1 - Goal

Most westerners largely underestimate the sheer size of refugee camps and resettlement areas in developing nations in crisis. The number of dwellings or tents or other structures can be as large of 100 thousand and more. In addition, they are constantly shifting in numbers as people move in and out.

2 - Data

The only real way to estimate numbers with some reasonable accuracy is to use satellite imagery. At the United Nations, UNOSAT is the organization for tracking those flows using that imagery. However, their work is extremely tedious and time consuming as images were labeled by hand. My goal was to come up with a solution.

## 3 - Model

The model I ended up using is a. deep convolutional neural network architecture called u-net. U-net is convolutional network architecture for segmentation of images. For my project, I used a revised the architecture such that the network takes as input images of real satellite images and outputs a gray scale probability map where the level of white of a pixel indicates the confidence that a particular structure is present within a single pixel. In a second step, I designed a filtering method similar to non-maximum suppression. Non-Maximum Suppression (NMS) is a technique used in numerous computer vision tasks. It is a class of algorithms to select one entity (e.g., bounding boxes) out of many overlapping entities. However, instead of bounding boxes, my filtering method return a single point which could then easily be counted as a single structure of interest.

## 4 - Impact

The convolutional neural networks were extremely accurate, saving the agency a considerable amount of time estimating numbers. Although I am unable the original results, the below image is a good representation of the input, output and final NMS filter would have looked like. It should also be added that this specific refugee camp is quite easy, even for traditional computer vision techniques. Other refugee camps, for example Gendrasa and Doro in South Sudan are much more irregular, yet the model still performed extremely well.

## 5 - Technologies Used