2023/2024 CASA MSc Dissertation Partner Project

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Supervisor name: Dr. Esra Suel

Partner organisation: UNITAC - United Nations Innovation Technology Accelerator for Cities

Partner website: <https://unitac.un.org/>

Partner supervisor name: Michael Hathorn

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Project title: Mapping Informal Settlements and Deprived Areas Using Satellite Imagery and Deep Learning Models in Central American Cities

Outline: We aim to map informal settlements and deprived areas using freely available satellite imagery and deep learning models in Central American Cities. Building upon our previous collaboration with UNITAC on building detection from images, this project seeks to extend our collaboration to the identification and mapping of informal settlements and deprived areas. We will leverage pre-trained deep learning models to analyse freely available satellite images from Central American cities.

In the initial phase, you will apply existing pre-trained neural networks to satellite imagery datasets, focusing on areas known for their high incidence of informal settlements and urban deprivation. The goal will be to assess the performance of these models in accurately identifying such areas. As the project progresses, and time permitting, we will delve into fine-tuning these pre-trained networks to enhance their performance specifically for the selected cities. This phase offers an opportunity to delve deeper into deep learning architectures and optimization techniques, with the ultimate goal of producing more accurate and reliable mapping models.

This interdisciplinary project combines elements of computer vision, machine learning, and urban development, offering a unique opportunity to make a meaningful impact at the intersection of technology and society, while also providing the opportunity to collaborate with the United Nations (UN) on addressing pressing global urban challenges.

Data: Freely available satellite images (e.g. Sentinel-2 satellite images). Cities of interest include the [SICA](https://en.wikipedia.org/wiki/Central_American_Integration_System) capitals: Belize City, San José, Santo Domingo, San Salvador, Guatemala City, Tegucigalpa, Managua, Panama City – the project most likely start with a single city as the focus and may explore others as time allows. UNITAC also has varying amounts of manually annotated data available for each city for evaluation/fine tuning

Possible methodologies: Deep learning and computer vision methods - semantic image segmentation (e.g. DeepLabV3).

Relevant literature:

Burke, Marshall, et al. "Using satellite imagery to understand and promote sustainable development." Science 371.6535 (2021): eabe8628.

Jean, Neal, et al. "Combining satellite imagery and machine learning to predict poverty." Science 353.6301 (2016): 790-794.

Xie, Michael, et al. "Transfer learning from deep features for remote sensing and poverty mapping." Proceedings of the AAAI conference on artificial intelligence. Vol. 30. No. 1. 2016.

Wekesa, Benson W., Gerald S. Steyn, and FAO Fred Otieno. "A review of physical and socio-economic characteristics and intervention approaches of informal settlements." Habitat international 35.2 (2011): 238-245.

Head, Andrew, et al. "Can human development be measured with satellite imagery?." Ictd 17 (2017): 16-19.

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I prefer to meet\*:

* Hybrid/flexible

\* This is not binding, but intended to help best match student and supervisor based on meeting preferences