



Mapping Urban Housing Density in Accra, Ghana with Sentinel-2

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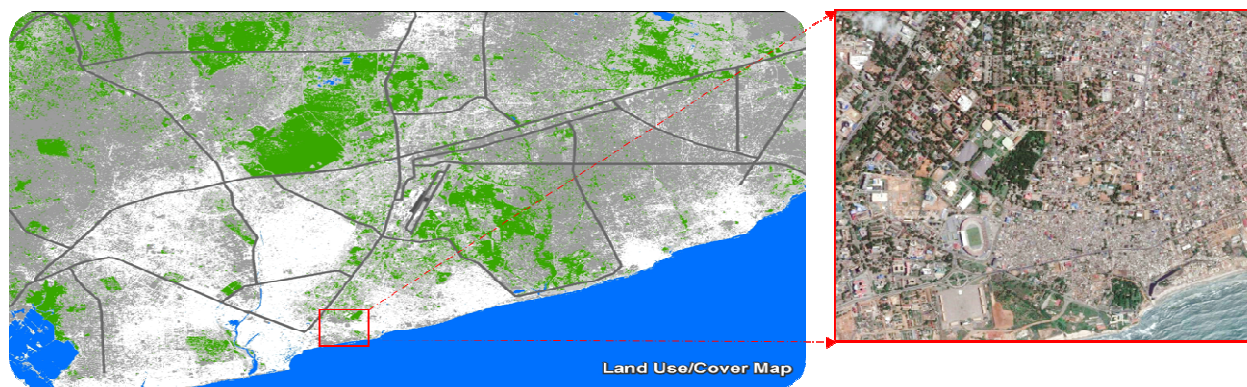


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Introduction



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Introduction of the problem

- With growing cities and changing demographics, rapid population growth of urban areas challenges proper planning.
- To ensure well-being and productivity of inhabitants, there is the need for adequate infrastructure and services e.g. water supply, housing and sanitation facilities, etc.
- It is therefore imperative to understand and monitor changes in urban density over time to help policy makers make informed decisions regarding resource allocation.



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Introduction of the use case

- The density of urban development has very significant implications for the upfront capital cost and ongoing operational cost associated with the provision of urban infrastructure.
- It also has very important implications for the provision of public transport services and the use of walking and cycling as means of commuting, with consequences for greenhouse gas emissions



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Outline of methodology

- The steps below outline how we mapped urban density using SENTINEL-2 imagery
- Download Level-1C SENTINEL-2 MSI from the Sentinel Scientific Data Hub (<https://scihub.copernicus.eu/dhus>)
- Data preparation (stacking 10m bands i.e. bands 2,3,4 and 8, and image subsetting/clipping, band combination)
- Unsupervised image classification (based on ISODATA algorithm)
- Reclassifying/Recoding spectral classes into 5 information classes.
(high, medium, low density, vegetation, water)



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Hardware and software

- **Hardware :**
 - i7 Laptop with 2.4GHz speed
 - 1 Terabyte storage space
 - 12GB Ram
- **Software :** ESRI ArcGIS
- **Data :**
 - Level-1C SENTINEL-2 satellite imagery obtained from
 - Sentinel Scientific Data Hub in .jp2 format
 - Project area extent in .shp (*vector format*)



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Technical issues and resolutions

- **Technical Issues**

- Limited internet bandwidth for downloading image
- Huge amount of storage space required to store & process imagery for regional level analysis
- Difficulty in interpreting image metadata
- Cloud cover over areas with high level of precipitation. Cloud mask unable to identify some cloud areas.

- **Possible Resolution**

- Provision of an online service to define and download only an extent of imagery rather than the entire scene
- Ability to download specific bands from Scientific Data Hub
- Provision of guidelines to interpreting image metadata



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Video demonstration

The video demonstrates how we mapped urban density using SENTINEL-2 imagery. By observing similar spectral reflectances exhibited by pixels in the images, we identified three (3) levels of urban density: high, medium and low density built-up areas.

Link to demonstration : [CERSGIS Urban Density Mapping](#)