Aims

This module will provide different methodologies, such as spatial interaction models and networks, to build models to simulate processes in urban systems, in particular those related to flows, such as commuting flows, and those related the relationships between agents, which can be locations, spaces, individuals or communities to name a few.

Objectives:

Part 1

- To understand that there are different spatial interaction models and their constraints

- To understand the role of the different parameters in the models

- To understand the principle of entropy-maximisation

- To understand the applications of spatial interaction models, such as the retail model

- To be able to use data and run the Python codes to calibrate the models

Part 2

- To understand the main principles of representing systems through networks

- To be able to use centrality measures in networks to identify hubs in the system

- To be able to differentiate between local and global measures

- To understand the principles behind community detection in networks

- To understand how to generate random networks and the role of the null hypotheses

- To understand how to construct different links and hence networks using the same nodes using proximity, spatial and similarity of characteristics

- To be able to use libraries in Python to visualise the networks.

Learning Outcomes

Upon completion of this course the student will be able to:

Part 1:

Construct a spatial interaction model of flows from a set of origins to a set of destinations in Python.

Calibrate the model using real data.

Select the appropriate model and the constraints given data availability and the spatial problem to solve.

Be aware of other modelling frameworks, such as ABM and CA.

Part 2:

Construct and encode a network as a list of nodes and as an adjacency matrix.

Understand the difference between local and global properties of the network.

Compute centrality measures of the network.

Detect communities in a network.

Construct different links for the same nodes considering different characteristics.

Perform a resilience analysis on the network.

Construct and visualise a network that is embedded in space.

Visualise the networks and their different characteristics.