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| **Company / Organisation Name:** | Locomizer |
| **Team / Department**: | Data Science |
| **Address:** | remote |

**Provisional title for project:**

Use of affinity profiles as a utility function to understand and predict dynamics of spatial segregation of populations

**Short description of the problem that would be addressed by the project:**

With remarkable significance in migration prediction, global disease mitigation, urban planning and many others, an arresting challenge is to predict human distribution, segregation and travel patterns in populated areas. A number of methods have been proposed against the above challenge, including the gravity model, the intervening opportunity model, the radiation model, the population-weighted opportunity model, and so on. Despite their theoretical elegance, all models ignored an intuitive and important ingredient in individual decision about where to go and where to spend time, that is, the attractive and repulsive interactions (affinity) between a person and spatially distributed opportunities: a) activities or Points of Interests (POIs) and b) other humans. Locomizer is proposing a new method to use location histories of a user, POI database and location histories of other humans to calculate individual affinity profiles (geo-prints) as a quantitative measure of human preferences, which can be used as predictors of individual and collective human behaviour in space and time and, ultimately, as a utility function in agent-based socio-economics models.

In the proposed project the student will design and perform research to

* Understand if the affinity profiles can be used as the utility function, which in turn can define the spatial preferences of people (as opposed to the "visitation" method of counting the nearest POIs around a user)
* Study spatial and temporal patterns of segregation of different types of affinity profiles in comparison with the available data on the distribution of socio-economic and demographics profiles, e.g. Census
* Develop an agent-based approach to study segregation dynamics of people using active matter approach in non-equilibrium Sakoda-Shelling models

The project is planned to be conducted in collaboration with researchers from the Tectonophysics Group, Ecole Polytechnique/Capital Fund Management, France in continuation of their published study “[Socioeconomic agents as active matter in nonequilibrium Sakoda-Schelling models](https://arxiv.org/abs/2307.14270)”

**Short description of the data sources that would be used in the project, and how they would be used**

Human mobility data collected via mobile apps, POI (Points of interest) database, database of individual geo-prints calculated using Locomizer’s method described in the patent “[Interest Profile of a User of a Mobile Application](https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2013179071)”

**Would any work by the student need to be carried out on site at the Company (with the exception of supervisory**

**Meetings)?**

No

**Any issues of data confidentiality and IPR that would need to be resolved**

The assumption that all IP, which could potentially be generated during this project will belong to Locomizer.

**Essential skills**

Statistical physics, non-equilibrium systems, agent-based modelling, python

**Desirable skills**

Machine learning (convolutional neural networks (CNNs) and Siamese networks)

**Preferred degree programmes (if any)**

Any

**Preferred selection method**

Any

**Support and training offered by the company**

Full support is offered but training to a certain degree

**Financial assistance offered by the company**

£500 stipend on successful completion of project.

**Any other comments**

If there are any questions about the 2025 programme, please contact Richard Arnold at richard.arnold@ucl.ac.uk.