

# Design-based approaches to investigate and optimise data quality of crowd-sourced observations for environmental monitoring

**Scope:** Europe has invested a significant amount of resources in infrastructure and services to achieve an autonomous, accurate and multi-level Earth observation capacity. Initiatives such as Copernicus or similar (INSPIRE Infrastructure for Spatial Information in Europe, UrbanAtlas) have been seminal in providing a mapping of spatial planning, forest/agricultural areas, wetlands or artificial surfaces; yet, clearly the burden of investing in additional equipment or of maintaining the current infrastructure is unsustainable.



Innovative ways of complementing the in-situ infrastructure with citizen-sourced data from thousands of mobile sensors at a lower cost are thus being sought. Whilst citizen participation in the environmental policy making process is still in its infancy, there are signs of a growing interest. This research is in the context of the Scent project (<https://scent-project.eu/>), funded by the EC H2020 Programme. In Scent, through a constellation of smart collaborative technologies, citizens will become the 'eyes' of the authorities and policy makers and will monitor land-cover/use changes through everyday activities. In this way, the costly in-situ infrastructure will be augmented with a people-generated and people-centric web of observations.

However and despite recognising the power and benefits of citizen science data, the data quality of observations is still ambiguous; innovative and at the same time reliable methods are being investigated for determining the data quality of observations or inversely, the data uncertainties. There are two categories of methods/ways this problem can be approached: (i) design-based approaches and (ii) runtime approaches. This thesis will concentrate on the first category. In this set of methods, the candidate will design and leverage techniques for preparing well-designed tasks for getting valuable crowd-sourced data and just allow a suitable crowd to contribute to the tasks. The candidate will provide an unambiguous design of the tasks relevant, which may include but are not limited to the following:

- o take smartphone images for several land-cover/use types within the Kifisos river area and annotate the image according to an image taxonomy/classification

- o take soil moisture measurements with a portable sensor and through a Scent-based smartphone app

- o report events that are relevant to the environmental problem at hand through a Scent-based smartphone app

Moreover, a second objective will be to research methods to determine an optimal set of contributors for each task according to reputation-based or credential-based methods.

In the context of thesis, field test experiments will be organised with a team of volunteers contributing to the task execution for testing the aforementioned methods and approaches.

## **Prerequisite Knowledge:**

- o Theoretical background on statistical analysis and/or basic data analytics
- o Some experience with programming languages (Python, C or Java).

## **Knowledge to be acquired from the thesis:**

- o Knowledge of the state of the art in citizen science and crowd-sensing
- o Hands-on experience with designing large-scale demonstrations of crowd-sourcing campaigns

## **Supervisors:**

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