Shaping Climate Resilience Policy

Using dynamic microsimulations to understand climate hazards and their impact on health

The Alan Turing Institute

About

This case study was created to support an AIUK fringe event and the AI for Climate Workshop held in Melbourne, Australia (February 2024).

A collaboration between the Alan Turing Institute, Data 61 (CSIRO), and the Centre for AI and Digital Ethics (University of Melbourne, these events aimed to bring together a diverse group of participants to explore the intersection of artificial intelligence, climate change, and decision-making processes.

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Licensing Information

Download this case study and others on the Turing Commons GitHub repository: https://github.com/alan-turing-institute/turing-commons

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CSIRO DATA 61

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Overview

This case study explores the use of dynamic microsimulations to model an individual's exposure to future extreme heat and predict its impact on population health outcomes particularly for vulnerable people (e.g. elderly, outside workers). Microsimulations are a computational technique used to simulate the behaviour and interaction of individual entities to predict complex system outcomes (e.g. effect of local weather patterns on the health of individuals). The goal is to use such methods to support public policy and enhance climate resilience.

Project Description

Climate change is increasing public health risks like extreme heat exposure. Traditional modelling approaches use broad measures of heat, assuming uniform exposure across populations. However, in reality, exposure to heat varies significantly among individuals, and can affect vulnerable populations especially.

An UK-based research team has developed an AI-based microsimulation to predict the impact of extreme heat (i.e. the hazard) on vulnerable individuals. During their project, they have collaborated with public health officials and policymakers to simulate individual-level effects under different climate scenarios.

Their method uses individual data (e.g. movement patterns, socio-economic status, and health attributes), generated from *synthetic population datasets* that are representative of the UK population. These data are combined with future climate projections, tailored to local areas. The team also use a risk assessment framework to estimate key variables (e.g. `'vulnerability'`).

Encouraged by their initial success, the team wants to scale their system, globally. It is important they maintain its efficacy with varied demographic and activity data, to ensure it remains a comprehensive tool for informing policy and building climate resilience.

Key Issues

- **Generalisability of the AI-based microsimulation to different countries**
- **Data privacy and protection**
- **Trust and social license. Attitudes and acceptability of system's use across countries**
- **Interpretability and explainability of system behaviour to support decision-making**

Deliberative prompts

1. **AI-enabled tools and techniques (e.g. microsimulations, digital twins) are claimed to "support local-level decision-making". What needs or capabilities are required at the local level to ensure this opportunity can be realised? How will variations across geographical (e.g. sociopolitical differences) be addressed?**

2. **What assurance would need to be provided to different stakeholders or end users to ensure they are confident in deploying a tool in a new environment (e.g. evidence of performance, means for contesting or reviewing outputs?**

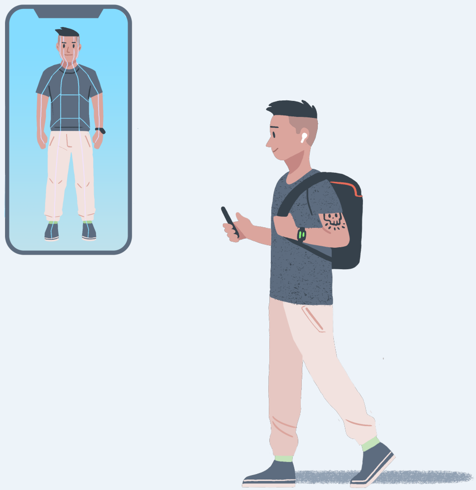
3. **What technical and ethical tradeoffs are important to consider when using real vs. synthetic population health data for the model?**

Technology Description

This tool is based on dynamic microsimulation modelling, designed for scenario projections at a high spatial resolution. These models require as input climate projections data and population health data which are aligned to identify vulnerable population groups in a local area across space and time. The population health data can draw from synthetic population data, which is enriched with socio-economic and health attributes using iterative proportional fitting techniques. Regional climate models deliver the temperature data and need to be bias-corrected for reliable predictions at a spatial resolution matching the population data.

Datasheet

Category	Details
Available Data	• Synthetic population data enriched with socio-economic and health attributes • Regional climate model data including temperature changes and rainfall • Daily movement patterns of individuals • Health baseline probabilities • Spatial data for hazard rating and zoning
Analysis Techniques	• Dynamic microsimulation modelling • Iterative Proportional Fitting techniques for data enrichment • Bias-corrected regional climate modelling • Risk and exposure assessment algorithms for health metrics • Spatial segmentation and hazard rating analysis



Groups, Organisations and Affected Individuals

1. **Vulnerable Groups (e.g. elderly, chronically dehydrated, military personnel, outside workers)**
2. **Healthcare Professionals and Providers (e.g. emergency response, doctors)**
3. **Local Government and Policy Makers**
4. **Climate Researchers**