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Foodinsecurity.london: Developing a food-insecurity prevalence map for London - a machine learning from food-sharing footprints

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Introduction & Background

The ability of policymakers to positively transform food environments requires robust empirical evidence that can inform decisions. At present, there is limited data on food-insecurity in the UK that can be used to inform interventions by local authorities, due to the prohibitive costs and logistical challenges of administering longitudinal surveys. This study builds on existing research and a key pilot study developed in partnership between Olio - a food-sharing app with 7 million registered users as of 2023, the University of Nottingham and Havering Council in 2020, which resulted in the world's first map prototype of food-insecurity.

Objectives & Approach

Our approach leverages Machine Learning methods applied to unprecedented food-acquisition behavioural data and open area-level deprivation statistics to model and predict individuals' experience of food-insecurity across London. We used Olio's extensive network of users to distribute 2,849 surveys, asking respondents across London about their experiences of food-insecurity. The survey was distributed online, adapting the US Department of Agriculture Food Security module. Respondents were asked about their experiences, including (1) eating smaller meals or skipping meals, (2) being hungry but being unable to eat, and (3) not eating for a whole day, because they could not afford food or because they could not get access to food. Using the household, rather than the individual-level version of the food insecurity module helped shed light on the experience of vulnerable groups - such as children.

Relevance to Digital Footprints

The survey responses provided a ground truth about users' experiences of destitution. Deprivation metrics and digital footprint data in the form of food-acquisition behavioural data were then used in a Random Forests Machine Learning model to predict whether households were experiencing food-insecurity, achieving high accuracy. Food-sharing data from almost 50,000 London-based users active on Olio's platform were then used to identify relevant food-seeking behaviours and aggregate recognised instances of food-insecurity at neighbourhood (MSOA) level.

Conclusions & Implications

To identify and rank relevant socio-demographics and food-seeking behaviours most informative for describing food-insecurity an extensive variable selection analysis was performed. The resulting SHAP (SHapley Additive exPlanations) values showed that a combination of food solicitation and the general deprivation of an area were important predictors of food-insecurity.