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Evaluating the Impact of Cultural Events Using Machine Learning and Digital Footfall: a Case Study of Bradford City of Culture 2025

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Introduction & Background

Cultural events are hugely important, yet the UK's arts, culture and heritage sector struggles to evidence its social, civic and economic value due to fragmented, inconsistent and insufficiently granular data. These gaps hinder the sector's ability to develop policy, attract investment, and align local and national strategies, pointing to a need to unite various data sources to better understand the impacts of cultural events. Digital footprint data can fill these gaps.

Footfall data derived from digital footprints, in particular, can support our understanding of the impact of cultural activities on neighbourhood vitality. Footfall, i.e. a measure of the number of visitors to places, serves as a proxy indicator for town centre vitality and viability. This case study aimed to evaluate the success of the Bradford City of Culture 2025 programme by investigating changes in footfall patterns across the Bradford district.

Objectives & Approach

Daily footfall count data derived from mobile applications (e.g. weather, gaming and transport apps) were combined with local weather conditions and temporal contextual factors (day of the week, bank holidays, etc.), to model pedestrian activity. A machine learning approach, specifically Random Forest Regression, was trained using data from 2019 to 2024 to estimate expected footfall during 2025 in the absence of cultural events. These predictions were then compared with observed counts, to identify over- and under-predictions and their spatio-temporal dynamics, representing 'excess' moving population, attributable to cultural activity after accounting for all other important drivers. Similar methods have previously been used to evaluate the impact of extraordinary events, particularly research on the COVID-19 pandemic.

Relevance to Digital Footprints

Digital footprints, specifically mobile phone footfall data, are used as a new data source to understand and quantify the impact of cultural activities on neighbourhood vitality.

Results

Although results from the model are by no means definitive, the model achieved good predictive performance allowing to predict normal footfall patterns based on contextual factors in five areas of Bradford. For instance, in Bradford City Centre, annual footfall was 6.8% higher than expected in 2025, compared with a naïve year-on-year increase of 12.4%. Feature importance analysis identified location and the COVID-19 period as the strongest predictors of footfall.

Conclusions & Implications

While exploratory, this research demonstrated the potential of mobile app digital footprints and predictive modelling to strengthen cultural impact assessment, supporting evidence-based decision-making for event organizers, funders and policy makers.

Keywords

machine learning, footfall, cultural impact assessment, urban analytics, modelling

