Assessing the impact of broadband inequality in Liverpool City Region: Identifying the causes of broadband inequality

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Background and motivation

The internet is a powerful technology, and those who have access and can use it effectively are exposed to many more opportunities than those who do not have the skills and access. This is described as broadband inequality.

As the internet becomes more prevalent in everyday life, reducing broadband inequality is imperative to ensuring that societies develop in an equitable and fair manner; if this inequality is not tackled then it will be the already disadvantaged who miss out on further opportunities. Measuring this inequality, and the factors that are associated with it, can provide local government with the information needed to help target resources in specific areas in an effort to reduce broadband inequality.

Data and Methods

In this study data was used from the 989 lower-layer super output areas (LSOA; a small geographic area, similar to a neighbourhood) in Liverpool City Region Combined Authority (LCRCA) on broadband download speed, average data use, age, education, annual income and urban or rural location.

Two regression methods were used to identify associations between download speed, and separately data usage, and the above mentioned variables – resulting in four regression models. Linear regression provided an overview of interactions at a City Region scale, whilst geographically weighted regression (GWR) allows for the inclusion of the impact of local spatial interaction, which can provide a detailed description of how variables interact at a local scale. The r^2 values (the amount of variation described by the model) and coefficients from each GWR model were then mapped, enabling the model fit and the strength of the relationship to be described at the LSOA level. Examples of this can be seen in Figure 1 and Figure 2, respectively.
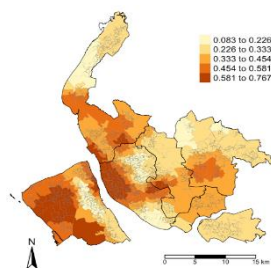

Figure 1 - Example of local r2 values

Key findings

The use of GWR highlights the complex local relationships of broadband inequality in the LCRCA. Compared to linear regression, the GWR models explained more variation in both average download speeds and data usage across many areas of the City Region. However, the amount of variation explained by each model differs geographically, with each model only having very good model fit in specific areas of the city region (Figure 1). These models are therefore of particular use for examining the relationships influencing broadband inequality in those specific areas where they have a high model fit.

The geographic distributions of the coefficients for each independent variable (the strength of the relationship between the dependant and independent variable) were complex and dispersed (Figure 2); simply there are many different relationships between average download speed and average data uses, and their respective independent variables across the LCR.

Some strong relationships could still be identified. In both models the proportion of the population aged 65+ and the proportion of the population with the highest level of education attained being Level 1 or below (equivalent to GCSE grade 3 and below) had a significant relationship with average broadband speed and data usage.

Value of the research

The use of GWR emphasises the importance of incorporating local spatial relationships into large scale geographic analyses. The relationships described between the variables in the models do not produce easily generalisable geographic patterns, which is often considered undesirable. However, these results highlight the complex factors that influence broadband inequality across the LCRCA, with models fluctuating in predictive strength, and variables able to have a different strength and direction of relationship depending on the local area within the City Region.

This dissertation therefore demonstrates the importance of being able to observe local relationships within a larger context. When applied to tackling broadband inequality in the LCRCA, these findings show that a strong focus has to be placed on enforcing strategies personalised for each local area, instead of a 'one-size-fits-all' approach.
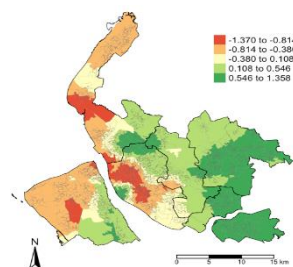

Figure 2 - Example of local coefficients: Aged 65+ and average download speed, MB/s