Measuring immigrants integration through urban mobility patterns

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MOTIVATION

Driven by globalization, ethnic diversity is increasing in major cities around the world. This process creates the political challenge of designing policies that ease the social integration of immigrant communities, as well as promoting the need for improvement of social support systems, and so reduce the chances of ethnic and political frictions. The natural question is how to evaluate the immigrant integration, we argue that integration can be reflected by segregation-related mobility patterns. In this summer school, we have two goals. First, we will present a data-driven methodology that extends segregation metrics to incorporate daily mobility and also quantify the effects of the urban form. We will analyze the dynamics of mixing and also discuss how it can be disentangle from residential segregation, policentricity or monocentricity of cities. This methodology also allows us to quantify the racial exposure of residents at a neighborhood level (census tract), the substrate of the second goal. We propose to explore how this daily exposure predicts political support and crime outcomes. Our hypothesis is that supporting welfare state, and thus voting left-wing political parties, could be a good proxy of social cohesion. We will use data from Los Angeles, Boston and Bogota. Less is clear about crime statistics with respect to segregation.

Successful immigrant and diverse societies are likely to have important cultural, economic, fiscal, and developmental benefits. However, the opposite case can produce escalating ethnic tensions[1], social and political polarization (i.e. the recent "gilets jaunes" riots in France) that end up eroding the social cohesion in a country. The integration of immigrant communities may be affected by spatial segregation, a well studied topic in geographic and social science research. However, the vast majority of these studies, have focused on residential segregation, despite the fact that most of the impacts of segregation are felt through the environments to which people are exposed during the day- their "activity spaces"[2]. Thus, understanding segregation as a spatio-temporal experience, we are interested in measuring exposure and evenness (mixing). To do so, we use existing block level data sources (i.e. Census demographics) to extract the race/economical categories for each city. In the latter case, as a first approach, we use the median household income categories. Having defined the race/income categories, we study the segregation, i.e. evenness and exposure, in daily mobility by tagging these categories to each trip into the mobility model TimeGeo[3], a modeling framework able to generate individual trajectories in high temporal resolution from mobile phone data. The locations of each individual is labeled as home, work, other. An the other type of locations can be explorations (visited only once) or repeated destination choices. The modeling framework can flexibly adapt to input data with different resolutions, and be further extended for various modeling purposes.

As a first step, we will synthesize the rich body of work on static characterizations of racial/socioeconomic structure in cities with dynamic models to better understand different racial/income fragmentation in the aforementioned cities. This step is both an extension to static segregation literature and a evaluation of current mobility models. Second, we add the temporal dimension in the segregation metrics. Once we are able to extract mobile-phone based urban mobility model separated by homogeneous groups, we will focus in the following questions:

- How do mobility patterns, based on activity-space, travel times, and number of trips vary for lower-wage workers compared to trips originating from higher-income areas?

- How those segregation-related mobility patterns are affected by the different demographic distributions in different cities?. Can we explain segregation patterns between cities?
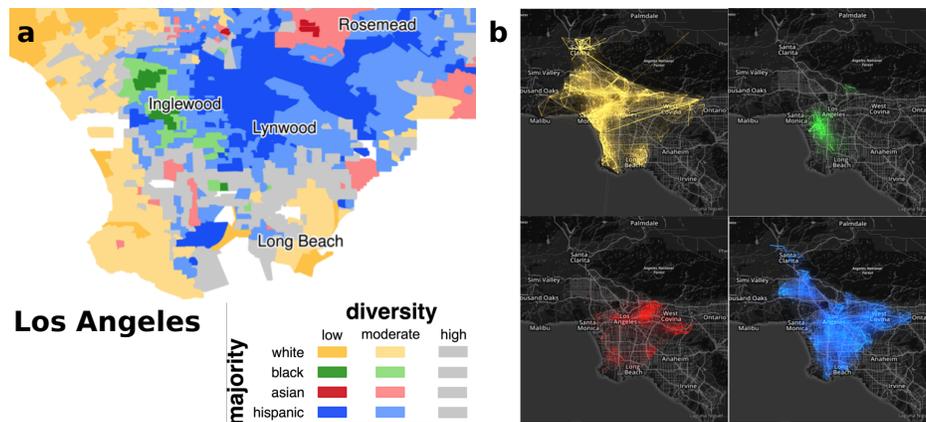
Figure 1. Los Angeles Case Study: (a) In the standard approaches of home based segregation, diversity of each location can be determined as the entropy of its racial distribution. Dark yellow refers to a location that is most important in the white network and "low diversity", light yellow refers to a location that is mostly important in the white network but "moderate diversity" in network importance. This convention holds for all races. Grey indicates "high diversity" meaning locations that have presence of all groups. **(b)** Home-based-other OD Networks by race, the edge opacity: and width is determined by the weight on that edge. Based on individual mobility, we can extend the measures of home-based segregation in its temporal dimension. Image sources:[4].

- We will characterize temporal exposure and evenness inside different activity centers in each city. For example, the central business district (CBD). How the evenness/exposure of the CBD captures the level of segregation in the city?

Having deployed this data-driven modeling framework, we propose a hands-on workshop to explore the daily mixing effects on political support and crime statistics. The argument is as follows. Across countries, greater amounts of ethnic division strikingly reduce the levels of social spending (welfare state) as a share of GDP[1]. At the individual level, people who live among poor people of the same race are more likely to support welfare, but those who live among poor people of a different race are less likely to support welfare[5]. As the welfare implementation depends on the ideologies of the political parties (i.e. left-wing supports it and right-wing not), analyzing the relationship between racial exposure and the voting preferences at the tract level could give us some insights of the well-being of immigrant integration. Segregation-related mobility patterns will add a new dimension in the evaluation of immigrant integration[6]. A data-driven methodology to study these processes is crucial for designing policies that ease the social integration of immigrant communities, as well as prompting the need for improvement of social support systems. Human migration creates the political challenge of designing integration policies to allow newcomers to settle in unfamiliar environments, as well as to promote their socioeconomic development and well-being. As this process can be affected by social polarization and spatial segregation, we want to enrich the classical notions of racial/economic segregation through the lenses of time and human mobility.

Economic and racial segregation have negative effects not only on people with lower incomes or racial/ethnic minorities, but on all residents and the region as a whole. Recent works suggest that human mobility is related to economic well-being, as it could improve economy and facilitate flows of people and goods, whereas constraints in the mobility can reduce economic opportunities[?,7,8]. Thus, understanding the mobility patterns related with social mixing is useful to analyze and evaluate the impacts of investments and policies to reduce social inequity and improving the urban quality of life.

Third, we will use existing data sources to understand where employment clusters are densest and to unpack what industries are driving that density within each city, who works those jobs, and where those workers live (e.g., LEHD LODES data provide block level data on jobs, wage and education levels of workers, and origin-destination pairs). But overlaying the cell record origin-destination information (by type of trip and time of day), and particularly the trip chain analysis, could reveal important patterns (e.g., for urban planning and for equity and inclusion goals) the employment data falls short of providing.

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