US Migration Simulator Lite 2K19 (Cities Edition)

By Python SuperSonics

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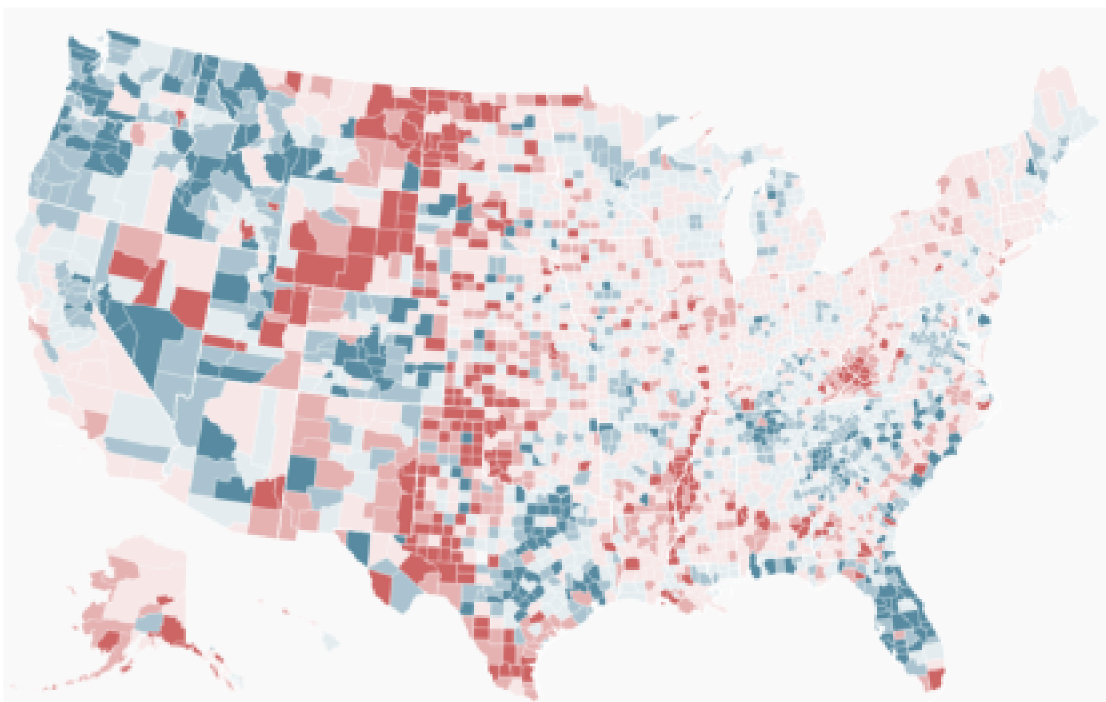

TABLE OF CONTENTS

INTRODUCTION	1
MODEL DESCRIPTION	2
ANALYSIS	3
TESTING	4
PERSONNEL	4
TECHNOLOGIES	5
BENCHMARKS	5

INTRODUCTION

The Oxford dictionary defines migration as the movement of people to a new area in order to find work or better living conditions. In today's world, migration is a common occurrence. As the United State continues to modernize millions of Americans will find their way to Urban cities around the world. This process, know as Urbanization can be observed all around the world. As such we wanted to simulate the migration of people to cities.

For our project, we narrowed down to 5 major cities: Seattle, Los Angeles, San Francisco, New York, and Chicago. We chose Seattle, as it allows us to better understand how our local community has changed, is changing, and is going to change with the increase in migration domestically and internationally. This can be primarily attributed to several technology companies like Microsoft and Amazon headquartered here. Both Los Angeles and San Francisco have seen a boom in migration due to one being the home to western pop culture and the other being the tech capital of the world. New York City has always been a center of migration, dating back to the Dutch colonizing the new world to find riches. As such, New York's rich history will allow us to better understand how urbanization has evolved over the years. Chicago is the most populous city in the Midwest, an area that largely rural. This fact allows us to understand how rural populations will react to urbanization with Chicago being the closest big city.

We will also simulate 5 different factors: Food, Water, Power, Taxes, and Pollution. A city needs to have enough resources like food and water to provide for the wellbeing of its residents. These factors will play a major role in our simulation. Food will vary depending on how many farms there are. We plan on extrapolating that data through further research. Similarly, we will account for where the city's water sources are and how efficient is their water treatment facility. Energy production data will come from public utility companies that service that area. For example, Seattle's power comes primarily from Seattle City Light. We will also simulate how cities change their taxes as more people could mean an overall decrease in taxes. This will be evaluated by looking at the city's income or sales tax over the course of the last few decades. With urbanization, there is bound to be an increase in pollution, whether from cars or power plants, and that is also something we will simulate.

Cities also have a negative migration flow, as in they lose residents. That is something we are also considering implementing in our simulation. Incoming and outgoing populations will lead to net positive and negative migration. This will, therefore, affect how our cities change with regard to the aforementioned factors. Fewer people (or more people migrating out of the city) will lead to surplus of food, which may lead to a better economy. This will be reflected in each city.

Furthermore, we also want to implement an economic system that will emulate the economy of the real cities. This will add further variety between our cities. As people migrate into the city the economy will improve as there is more production, however, there may be cases where the city may not be able to supply enough resources to the incoming population, therefore, causing an economic downturn.

MODEL DESCRIPTION

Our model will calculate the rate of migration between 5 cities: Seattle, Los Angeles, Chicago, New York, and San Francisco. The model calculates the rate of migration of each city by taking account the rate in certain fields to the calculating process, such as economy rate, crime rate, jobs availability rate, technology industry development, etc. In addition, it will also give the rough plot of the changes in population in these 5 cities affected by migration.

We assume that these 5 major cities - Seattle, Los Angeles, San Francisco, New York, and Chicago - are the cities where Americans most likely live in (assuming that 65 - 70% Americans live in these cities). Keeping this assumption, we could say that the average migration rate from these cities can depict the approximate average migration rate of all cities in America. We would also assume, although might still need considering, that these 5 cities will start with the same amount of population. We thought that by running the model with the cities having the same initial population, we can actually get a real depiction of each city's migration rate look like.

We constrain our model by narrowing down our objects used in our model to 5 major cities in the United States: Seattle, Los Angeles, New York, San Francisco, and Chicago. Moreover, we can limit the range of years we are getting data. We do not think it would be useful to get data from 50-60 years ago and instead get data from the past 20-30 years as that would be more accurate for us to model.

This model can be used for predicting how major cities will look in the future. This can be useful knowledge for cities because then they can adjust to account for the new people moving in, estimating the future economy of the city. This can help give notice to cities about how many people they would expect in their city.

This model can be used to solve certain problems such as over-population in a city. If they are estimating several thousand to hundreds of thousands of people moving into the city, then they can adapt and be aware of the future. This can reduce the risk of overpopulation occurring in the city.

A limitation that may occur in our model is estimating the future economy of a city. This is because the economy will rely on so many different factors and variables that it can be hard to determine and estimate what the future economy would look like. The economy depends on how many people are moving in, how much money they are making, and also how the country is doing as a whole.

Ignoring anything drastic, such as a nuclear war or another economic crash, we can assume that the economy will grow at a constant rate and not account for the scenarios where the absolute worst thing could happen.

ANALYSIS

By analyzing our model, we wish to see how migration rates will change over time in the 5 major cities. First, we will look at the obvious, which is the population but then we want to see how that population will have an effect on other aspects of life. Such as the economy, how will the economy grow due to the migration. We also wish to see how the environment will change and more specifically, we want to look at the pollution rates would change. Will crime rates increase as the population increases? These are some of the questions that we wish to answer.

Our model should depict how a city will change over a specified amount of time. This will allow us to see the changes in the distant future (5 years), to the far future (20 years), and after our lifetime (100 years). This will help answer the question, how does migration affect the local community? Will it have a positive or negative impact on residents? Will society be stable in a 100 years? Or will the population grow to an amount that is unsustainable?

Before we validate our model we first need to verify our model. This means before execution we will look back on this development plan and see if we matched exactly what we said we said we would do. This means making sure we implemented each module correctly and that it conforms to the requirements we set. If everything looks to be how we specified it to be then our model will be verified. Next, we need to validate our model.

In order to validate our model for accuracy, we will use past migration rates over time and analyze the change over a year to year basis. This will allow us to get a rough estimate of what the actual number should be. We could also use our model to figure out a prior period of time. For example, from the year 2000 to 2019 and then use the values from our model to actual values and see if our model is close to the actual value. If the model comes to similar result as the actual value then we'll know that our model will be valid.

TESTING

We plan on using 2 main types of tests: Unit testing and integration testing. As we develop our simulation we will perform unit tests for individual factors in one city. Resources like food, water, and power will be tested first. We will then proceed to test both taxes and pollution individually.

After that, we will integrate our entire system and make sure all of our factors not only work independently but also interact with each other. As in, if power increases then pollution also increases. We will then test this with each of the cities. Since each city is a different size and also has different limits on resources, we will have to ensure that our tests match our predictions.

By first testing the modules as a separate unit, it will reduce the amount of testing and bugs introduced when we integrate it into the system. This will prevent the amount of extra time spent debugging and allows us to allocate that time elsewhere.

We will also test to ensure that each factor contributes to change in the economy and that a different set of factors will lead to a different effect on the economy.

Overall, we need to ensure that the simulation evolves correctly and none of our loops create any big errors.

PERSONNEL

DJ Wadhwa

- Team Manager of the group
  - Ensures we are keeping up with the schedule
- Build the statistics suite to measure change throughout our simulation
- Implement initial city population and other resources
- Help in building the simulation functions, that affect the residing population and migrant population

Tarcisius Daniel Hartanto

- Testing (unit testing and integration testing)
- Gather data for the five cities
- Design outline
  - Classes/Method
- Build simulation functions

Branavan Nagendiram

- Gather data for the five cities
- Design outline
  - Classes / Methods
- Verify / Validate model after implementation
- Build simulation functions

Gahl Goziker

- Build core simulation functions
- Write the main function as well as create objects

TECHNOLOGIES

The main program we will use on our project is Github. This will be essential to us as it provides us an easy way to collaborate our code and record any changes done in our project. It will allow us to see what has been done, and what still needs to be done. It also provides us an easy way to document our project as well. It allows for remote working so we do not need to be working at the same location.

For writing up documents, like this one, we will be using Google Docs as it allows us to work on a document at the same time and see changes in real time allowing for easier collaboration.

We also use Discord to keep track of our project's timeline. This can be used to ensure if we are keeping track on time. If we happen to be behind schedule, then we will realize it ahead of time and we can make up lost time before it becomes too late. We also use Discord to communicate either through text or voice chat and talk about directly on what needs to be done and what has been done (to avoid double-work on something that has been done). It also allows us an easy way to ask questions, if we happen to be stuck or just wondering about what needs to be done.

BENCHMARKS

1) Gather Data (Finish by May 22nd, 2019)
    a) Research 5 cities, Seattle, Los Angeles, San Francisco, New York, and Chicago
    b) Look at the migration, economy, pollution, etc rates for each city per person.
    c) Determine an equation for our model.
2) Document Project Outline (Finish by May 24th, 2019)
    a) Diagram containing any classes/methods that may be used
    b) Plan out unit and integration testing
3) Milestone: Prototype Migration Simulator (Finish by May 29th, 2019)
    a) This will have, at the minimum, the population, food, and water, aspect of the model working correctly.
    b) Started work on all the modules, but some elements may still be in beta.
4) Final Software Product (Finish by June 4th, 2019)
    a) All modules will be working correctly with all major bugs discovered and fixed
5) Project Presentation (Finish by June 4th, 2019)
    a) We will walk through our model, explaining and showing how it works.
    b) We will describe what we learned from our model and how we determine our model is accurate and valid.
    c) Have a powerpoint containing a description of our model.