TJHSST Senior Research Project
A Dynamic Model of Human Populations
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Abstract

The world is becoming better interconnected. As more and more people in developing countries seek to live in economically secure ones, less and less people stay in their own. This constantly changing flux of movement highlights just how important understanding the dynamics of human population is. This project attempts to analyze and understand the growths of a population and the migrations of people across the world. Through understanding how human populations develop, we can predict changes in the future.

1 Introduction

1.1 What is so important about population models?

The human population of the world is now at 6 billion and counting. It is constantly growing, constantly moving. To even try to use human power to analyze all of this data would require thousands of people and thousands of hours of man power to complete. By using computers, we can drastically cut down on the man power needed.

1.2 Why does it matter?

This project can be useful for a great variety of problems. Most prominently, the US takes a census report every ten years. But every decade in between,

the census department uses the data gathered to estimate population values. A dynamic model such as the one this project would achieve would be invaluable in assisting their efforts.

2 Background

Similar research:

1. Surface modelling of human population distribution in China

    - The researchers of this project split the population into units of grid-like nature. They analyzed this data in order to create two concurring predictions for 2015 under different assumptions. It is a similar project to mine, but limited to only China, with a great amount of emphasis on historical context.

2. Human Population Dynamics Revisited with the Logistic Model: How Much Can Be Modeled and Predicted?

    - The researchers in this project attempt to analyze the problems and reliabilities of logistics curves use to model and predict human populations. They concluded that although logistics models can be used to predict death within 80 percent, long-term birth and death rates cannot be fully predicted. Therefore, my project will attempt to predict values in the near future, at most a hundred years.

3. A Stochastic Population Model Related to Human Populations

    - The researchers use probabilistic factors in order to predict population data. They take into account factors of marriage, age, sex, and migrations. This project is very mathematical in nature, and applies less to this project than other research does.

3 Procedure

This project works by calculating a population growth rate value using population data for a certain group. First, it starts from the states level. The

growth rate is calculated for historically rich states such as Virginia and New York. Then, it moves on to the entire US, in which it obtains the growth rate for each and every state. It takes those rates, displays a graphical representation of the growing population with it, and calculates the growth rate of population for the entire country. A future model of the world will also be created in a similar fashion. I also plan to add a migration display to my models. After the models have been made, we can move on to the testing.

4 Preliminary Testing

Testing at a basic level is done by comparing my project's predicted values with those of the US census. The most recent US census estimates are of the year 2005. My predicted values for that year compared with the census' should be relatively close. The predicted values would then be used to craft graphs to compare with past growth rates.

5 Analysis

If my model works correctly, I expect my graph to look like a J-shaped graph. I also plan to include in my analysis age pyramids to analyze reasons for a certain growth rate. Demographic transition graphs in conjunction with the age pyramids would be used to show what the change in growth rate means. And a somewhat final, conclusive graph would be used to show the changes in growth rate due to historical implications, such as the advent of the developed world.

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