**Name:** Kenneth Cox

**Faculty Supervisor:** Sergey Paltsev

**Direct Supervisor:** Jennifer Morris

**UROP Location**: Cambridge, MA

**Term:** Fall 2022

10/28/2022

**Scenario Discovery Approaches for EPPA Model Data Analysis**

**Project Overview**

My direct supervisor, with whom I am conducting this research, is Jennifer Morris (MIT Energy Initiative and MIT Joint Program on the Science and Policy of Global Change). My Faculty Supervisor is Sergey Paltsev (MIT Energy Initiative and MIT Joint Program on the Science and Policy of Global Change). I will also be collaborating with Jonathan Lamontagne from Tufts University. This fall, we will be finishing our paper illustrating the use of scenario discovery applied to an ensemble of a climate model with exogenous variables parameterized by sampling from probability distributions drawn from the literature. The project will use the EPPA model as the data source. The spring project is a continuation of the work I have done since IAP 2021.

The EPPA model is a global climate model that takes in inputs from over a dozen critical systems on the planet, including various energy production systems, agricultural sectors, and industries, and returns predictions for outcomes of policy interest including emissions, renewable energy production, and economic variables like GDP. We will focus on the EPPA model’s predictions for targets under a range of possible scenarios (i.e., different combinations of the inputs of the model), encompassing both regional and global predictions.

Scenario discovery is a framework designed to make sense of large amounts of data that contain deeply uncertain factors. The EPPA model has dozens of specific inputs drawn from its major systems, which can make it difficult to determine which inputs have the most impact on the outcomes of interest. Using the classification/regression trees (CART) algorithm, along with classical statistical techniques and modern data visualization, large amounts of data can be sifted through to reveal the most salient features and patterns in the data.

As time allows, we may also begin working on developing a broader understanding of the input probability distributions of the EPPA model.

**Personal Responsibilities & Goals**

As previously, I will process data sent to me by my supervisor and conduct all analyses in Python. I will organize the data in tables, graphs, and other visualizations, and discuss results with my supervisor. By the end of the summer term, we hope to submit a paper on our results.

**Remote Work Plan**

This project can be conducted remotely without issue. Most of the work involves analyzing data, which can be done on my computer from a remote location. I can also search for relevant literature from my computer, if necessary.

I will keep in contact with my supervisor via regular video calls and email.

**Personal Statement**

I am interested in the mathematical modeling of systems important to human society and how those models can be used to inform policy. The climate is a particularly important system to model, and while models can’t fully capture its complexity, they can still help with our response to climate change. Using such models enables researchers to see which mitigation strategies will be most effective at achieving global temperature reductions by 2100. Moreover, some models, including the EPPA model used in this project, include socioeconomic factors. I think social impacts are an often-overlooked feature in modeling, so I am additionally interested in this particular aspect of the project.

The current pandemic has revealed both the strengths and weaknesses of mathematical models. I hope to continue to build my understanding of how uncertainty in models manifests itself as a weakness, and what researches can do to about it, while also developing the important skill of analyzing and displaying data.