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Data science is applicable in many ways when it comes to agent-based modeling, and these applications allow us to gain incredible insights into nearly any system that contributes to society and human development. From a simple logistic regression model to deep learning, we can apply data science to most any data in order to uncover patterns that will give us the ability to better understand adaptive, economic, and social systems. Being able to use a variety of data to understand these networks at both a high and low level is what the essence of agent-based modeling is.

One major benefit data science provides in this context is the ability to model or predict systems of any size. While the predictions are not always correct (sometimes due to how much data is available), it is better to have some understanding from our analysis than nothing because this gives us a general idea of what could possibly be the case. For example, in one study the researchers utilized publicly available satellite imagery and nighttime light data to get an estimate of economic well-being in African countries. They applied state-of-the-art data science methods like convolutional neural networks and the transfer learning approach, which are what enable us to do things like this in the first place. This is important because being able to predict and model things like this in countries that lack economic well-being survey data can help us further understand the economic systems of the world.

Additionally, we were able to use population data and DHS survey data to synthetically generate the overall population for an area of a country. This synthetic population could provide us with insight on the individuals that may be present in that area. The increase of higher resolution data has allowed our analysis to get more and more specific, to the point that we have data for individual persons in large scale quantities. I think that doing things like synthetically generating populations give us incredible gains in our ability to describe, analyze, and predict human development processes. We can look at trends within these data over both time and space to get a better sense of the human development in the area, and even use other data such as de facto settlements or migration patterns to further our analysis. It is important to recognize what Owen Barder has identified - systems are evolutionary. Thus, we need to be able to model these systems so that we can keep up with the evolution at hand and keep our model as realistic as possible. This is an especially present theme when looking at migration patterns; the location of peoples are bound to change, and we must try and follow those changes to some degree to fully understand a system or network.

Clearly, data science has many uses in the context of human development. However, it also has the potential to impact the community in both good and bad ways. If used properly, data science can be a means to enrich our community on both an individual and communal level. Uncovering trends in our own lives at both the individual and communal levels can help us make decisions that will better our society overall and foster more development between people. But while data science can do incredible things, it can also be harmful. Analysts that uncover traits of networks can use their research to exploit communities for their own good or simply be malicious toward them, which is not ideal.

Overall, I think that agent-based modeling serves as an incredible opportunity for the human condition to improve. Gaining a better understanding of the systems that we partake in daily can only help us make strides to further our lives. While there are some major obstacles present, such as lack of data availability, the analysis we can conduct is very helpful. Geoff West's observation that "data provide the basis for constructing, testing, and refining our theories and models" is important to consider. Without the data, we wouldn't be able to construct many of the models that have helped us grow as humans, which proves that data science and the use of data (especially in the context of agent-based modelling) can help advance our understanding of the systems and networks that make up our lives. I am glad that I was able to take a class in agent-based modeling because now that I understand all of these things, I can approach everything in my future as a data scientist with an agent-based spin.