Summary For Practitioners

Title:

"Economic Planning Using Computers and Artificial Intelligence"

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What Can Computers and Artificial Intelligence Do Regarding Planning?

Most often, "economic planning" connotes the planning done by governments, but it is broader, and encompasses the prescribing and following of a set course of action for economic activity. Firms do it when they choose the inputs they will use, determine the prices they will charge, and invest in future capacity. Individuals do it in their own lives when deciding to spend and save money and prepare for the future.

The primary contribution of computers is the ability to rapidly analyze vast quantities of data. If the analyses are designed in a way that offers something useful, computers can help individuals, firms, and governments determine the best course of action. Artificial intelligence (AI) helps by identifying trends in data that may be less visible or intuitive and making recommendations accordingly.

Economic Impact

Artificial intelligence and computing power may have an economic impact on both the extensive and intensive margin. Whether informing the planning strategies of firms or governments, the extensive effect consists of new strategies that differ from what was done previously. If AI is successful, new strategies will be more profitable than before. On the intensive margin, the economic impact of AI consists in marginal efficiency improvements. Most "planning" in the American economy is done by firms, with a smaller amount done by governments.

Smart Cities

Smart cities have been a prominent topic that attracts many advocates and critics. They are the place where government economic planning aided by AI and computing power finds its greatest near-term potential. Internet-of-things sensors gather data on energy use, water use, traffic, storm sewer capacity, and numerous other things. They are then used to allocate city resources to optimize energy use, improve traffic flows, detect and fight crime, etc. The possibility of such uses of AI and computing power is no longer a hypothetical construct. Whether they can successfully be used to operate a city is still an open question, as is the question of how prominent of a role AI can play in planning for firms or larger-scale governments.

Role in a Market Economy

In a market economy like the United States has, government planning comprises only a modest amount of total economic activity. Artificial intelligence has clear uses in things like fighting crime, military planning, and planning for public investment. Its potential role in planning the economy is smaller, mostly limited to improving the efficiency of government enterprises. Most of these uses are on the intensive margin as they are focused on improving and optimizing the performance of existing government functions.

In a market economy, AI's planning potential is most useful for firms, but even this is limited. Firms must plan their operations, including pricing and marketing strategies, input use, logistics, and economic forecasts. For firms, AI's most promising use in planning is also on the intensive margin. Any use on the extensive margin involves developing new products or strategies that are substantially more than incremental enhancements.

What Are the Limitations of Artificial Intelligence in Economic Planning?

For all the hype that smart cities have received, computers and artificial intelligence are not a silver bullet to solve urban problems nor do they solve problems at other levels of government. For firms, AI has a place in planning, but not on the extensive margin.

Human Effort

Regardless of its computational ability or apparent power to "think," no AI system is autonomous. The most obvious reason for this is that any recommendation it produces must be implemented through human effort. Firm managers still must make subjective judgments about whether to trust AI recommendations. In government, executives must do the same, but implementing recommendations is also a political matter subject to special interests. There is no guarantee that the recommendations will be followed. At best, AI effectively informs prudent decisions, but is not capable of carrying them out.

Reliability of Data

Computers can analyze larger quantities of data faster than could have been foreseen only a few decades ago. The ability of internet-of-things sensors and smartphones to gather data is also unprecedented. AI algorithms are not limited by the availability of data. Likewise, vast quantities of data are no hindrance in today's age of cheap, rapid computing power. The realistic capability of analyzing data quickly does not mean that the statistical inferences are precise or reliable.

Observed data, as complete and exhaustive as they may be, may contain errors because of collection issues or deliberate attempts to produce misinformation. All statistical inferences are subject to probability distributions and confidence levels. Statistical analysis can never generate proof or offer complete certainty, even when the data have no errors. Setting aside the likelihood that observed data contain errors, no estimate can be reliable if all relevant information is not included. This means that the mechanism for collecting information must collect everything that can matter.

The presence of errors in data is arguably a more severe problem when planning using AI. When data sets are large and are collected and analyzed in real time, detecting errors becomes more difficult and is still a nearly insurmountable task. Observational problems are one thing that may be corrected with time, but deliberate misinformation is not. Consider, for example, the use of mannequins by motorists who want to commute in an HOV lane. The use of the mannequin is an attempt to feed misinformation into the system to avoid getting fined. Anyone who wants to game the system has an incentive to feed misinformation into it. If someone can benefit from manipulating a planning system, an incentive exists to manipulate it. This is especially so when using AI to fight crime, as criminals have a powerful incentive to stay undetected.

Artificial intelligence algorithms are susceptible because they rely on the data they collect, whether those data are reliable or not. They draw inferences based on observed outcomes. Using unreliable data to predict actual outcomes gives recommendations that may be useless or misleading, and desired outcomes may not be achieved by following those recommendations.

Predicting What Cannot Be Controlled

Artificial intelligence algorithms operate in a "belief space" that models what will be done outside the scope of what the operators of the system can control. For example, in recommending traffic flows, the AI system must make judgments about weather conditions, the likelihood of sudden road hazards, and the probability of auto accidents. To optimize traffic flows, this seems intuitive enough as these things are predictable. To prescribe strategies for a firm, the algorithm must correctly predict what competing firms will do, which is a much harder task. To plan an entire economy, the system needs to predict preference choices for millions of people and the actions of every foreign firm that trades with that economy on top of all geopolitical conditions. That task is nearly insurmountable. AI is useful on small scales, but it cannot be used to plan an integrated economy. Its usefulness for individual firms is limited to things that it can be predicted without modeling too many things that cannot be controlled.

Usefulness of Recommendations

AI is useful insofar as it provides good recommendations. Recommendations are useful if they can realistically be carried out, which assumes that planners can do what the system advises. For firms, managers face legal constraints, and no useful AI system can recommend anything outside these constraints. For governments, individual freedom and the reality of politics are limiting factors. Suppose that an AI system attempts to optimize traffic flows and can figure out the best way to route cars to minimize traffic jams. Even with these recommendations, motorists are still free to drive on whatever roads they please. This can only be altered through unpalatable constraints on individual freedom. Variable tolls are a solution currently used in Singapore (which is not a beacon of personal liberty, despite having a free market), but these will only be implemented with time-consuming political wrangling. If recommendations for a collective are going to be followed, some element of coercive power must be used. Without the ability to fully utilize the capacity of AI because of these realistic constraints, the devices that power smart cities and planned economies are reduced to surveillance nets that have little meaningful impact. Expanding the government's coercive power is not an automatic solution because that also expands the incentives to create misinformation. At worst, this results in compulsory but useless recommendations.

Unintended Consequences

The goals of an AI system must be well defined, and they must be defined completely and with a high degree of precision. Consider healthcare as an example of an area in which AI could be useful. If the top goal is to maximize GDP, then the planning system would require every single medical intervention to be administered to a patient. If minimizing health costs is the top goal, the system would let all chronically ill patients die in impersonal fashion and make the population appear healthier because only healthy people would survive its decisions. If preserving life is the top goal, then a million-dollar drug that gives a patient an extra three days could be administered while non-life-threatening injuries go untreated. This is admittedly a stark example, but similar problems with the setting of goals could come up in many areas.

In a computerized planning system, there is no place for common sense to be used at the moment of decision; all things must be decided in advance. For firms that have limited economic scope, this may not be a problem. For governments, whether urban or national, this can be a major problem, especially because of their coercive power.

Incentive Problems

Aside from the incentives of participants to create misinformation, planners and programmers have incentives of their own. Few if any people are always satisfied with what governments do, yet many still place great faith in government to solve problems. Human firm managers make mistakes, despite having a powerful profit motive. Both public servants and firm managers are self-interested and some of them have ulterior motives. AI can help improve efficiency, but it does not solve all the problems that impede governments and firms in economic planning. It also does not solve the problem of self-interested government officials, firm managers, and employees. Moreover, the ability of AI to improve efficiency can magnify existing human problems.

Incentives for Planners

Firm managers and government officials have an incentive to enrich themselves. Ideally, they give their best efforts to the firm or constituents, but this is not always the case. Those who make plans, whether at the top or middle levels, can divert effort toward pet projects or things that personally benefit them.

Incentives for Programmers

Planners have perverse incentives, which they ideally ignore, but AI also introduces perverse incentives for computer programmers. The goals of any plan and the constraints that dictate how it can be carried out are abstract ideas that consist of words. Firm managers set goals for their firms and government planners set goals for society. These plans have no relevance until they are programmed into AI algorithms, and programming is a less transparent process than the setting of goals. It is possible that programmers could defraud firms or the electorate in a way that would be hard to detect. The efficiency of computer power, not always including AI, makes fraud and theft easier than before.

"Salami slicing," or the persistent use of small-scale fraud that adds up to a large amount over time can be easy and attractive for programmers in an AI-driven planning environment. There is an apocryphal account of a programmer at a bank who noticed that interest was rounded down to the nearest cent after being computed with a high degree of precision, leaving numerous fractions of cents unpaid. The programmer then added up all these fractions and deposited the substantial sum into his own account. Whether this story is true or not, it illustrates a problem with AI as a tool for firm or government planning. Because of the efficiency of AI, individual acts of fraud can be too small to detect, and planners who are not familiar with computer programming may not know how to detect such behavior. Top managers and planners can get more powerful insights and potentially make better decisions with the help of AI, but they are at the mercy of programmers. There is a risk that they will bear responsibility without control.

Conclusion

Artificial intelligence can be very useful in aiding government officials and firm managers in their decisions, but it is only useful insofar as its limitations are well understood. Its greatest use is on the intensive margin, to improve efficiency and guide the decisions of planners and managers. Use for autonomously making decisions and comprehensive planning falters because of data reliability, inability to accurately predict things outside the planning system, and unintended consequences. It also offers new opportunities for planners, managers, and programmers to enrich themselves as opposed to advancing state or firm goals. AI is useful, but only under certain conditions and for tasks on the intensive margin.