



Artificial Intelligence

A Guide for Government
Leaders

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The rise of artificial intelligence holds great promise for government at all levels.

AI in Government

Why should government leaders care about artificial intelligence (AI)? The answer is simple: because AI can help the public sector deliver better services to citizens at lower cost. In fact, the rise of AI holds great promise for government at all levels. Every government leader needs to understand how AI can benefit their organization by saving money, creating a better citizen experience, or in some other way. The opportunity is enormous.

To take advantage of this opportunity, you need to do a few things. First, you must understand some simple AI concepts and terms. Once you've done this, you should start thinking about scenarios, concrete ways that AI can help your organization. Reading this short paper will help you do both.

What is AI?

The idea of artificial intelligence includes many different things. Today, though, it's fair to say that the most important aspect of AI, the one that offers the most benefit to organizations like yours, is machine learning.

Machine learning helps us find patterns in existing data, then recognize those patterns when they appear again.

Despite the fancy name, machine learning does something that's easy to understand: It helps us find patterns in existing data, then recognize those patterns when they reappear again. For example, think about tax compliance. If you tie in artificial intelligence, it can be employed as a powerful tool for ensuring compliance by looking at past behavior. That could be late or staggered payments which might be attributed to a struggling business, for example. A tax agency employee can use AI and data to predict future behavior, and then work with the taxpayer to ensure compliance, but do so with a measure of empathy. Finding patterns like this in data can be hard to do manually. But when people can use computers—machine learning— it can make their jobs much more efficient.

There's one more idea you need to understand to be able to think clearly about machine learning: models. Look at the figure below.



Machine learning software finds patterns in data, then generates a model that can recognize those patterns when they occur again.

This simple diagram shows the machine learning process. Data, such as information about tax forms submitted in the last ten years, is read by machine learning software. This software looks for patterns in the data, such as a strong correlation between certain behaviors and tax fraud. The software then generates a model that's able to recognize those patterns in the future. To fight tax fraud, for example, an organization might use this model to check every submitted tax return, then flag every one that fits the pattern that model can recognize.

Machine learning can be useful in many different areas: reading license plates, understanding human speech, and lots more. Yet it depends fundamentally on creating good models. But creating these models commonly requires data scientists, highly specialized professionals who are difficult to hire (because they're scarce and expensive) and difficult to keep (because they're in such high demand). Is there another way?

Why build a model yourself if you can use one that already exists?

The answer is yes. Rather than building your own custom models, it's often possible to use pre-built models defined by others. This is especially true for common situations such as finding images and recognizing speech. Doing this saves you both money and time. Why build a model yourself if you can use one that already exists?

The Microsoft Difference in AI

If your organization needs to create custom models, Microsoft has tools such as Azure Machine Learning Studio to help you do this. These tools are meant to be used by both professional data scientists and less-skilled people.

But Microsoft also provides a broad set of pre-built models. Called Microsoft Cognitive Services, these models address many common scenarios, including image recognition, interpreting human speech, and lots more.

Building your own model requires time, money, and skilled data scientists. Using Microsoft's pre-built models whenever possible makes much more sense. The ability to do this, combined with a range of tools to create new models when you need to, is why Microsoft is the right choice for your AI projects.

AI is real, and it's here today.

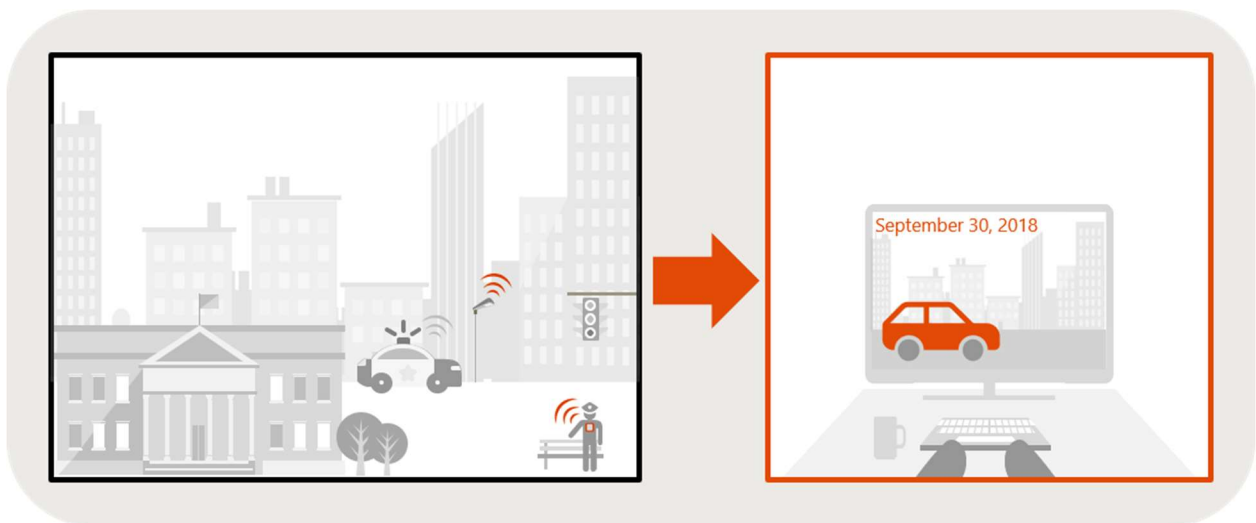
Some example scenarios

AI is real, and it's here today. You can use machine learning and other aspects of AI to make things better right now for you, your employees, and the citizens you serve. The scenarios that follow show a few examples of what's possible.

Improving public safety

Many cities today are drowning in video. The increasing use of fixed video cameras can be a critical part of improving public safety, as can the body-worn cameras worn by many police officers. But the volume of video produced by these cameras is hard to work with—it's just too much for people to watch and manually process after recorded.

Using AI, however, you can have software review every recording you create. Because computers are so much faster than people, this software can find what you're looking for much more effectively than humans. For an illustration of this, look at the figure below.



Visual recognition software can analyze video collected from fixed cameras and police body-worn cameras, recognizing objects, and more.

In the example shown here, video is collected from fixed cameras and police body-worn cameras. This information is then analyzed by video analytics tools. This software is remarkably powerful. It can, for example, find all frames that contain a certain car color, make, and model in a specific area between noon and 3 pm on September 30, 2018. It can also

Model-based software can find all frames that contain a certain car color, make, and model in a specific area between noon and 3 pm on September 30, 2018.

generate an indexed transcript of the words spoken on the video, including translation into different languages.

The benefits of this are clear. For public safety, police officers can write fewer reports, because AI software can analyze the video as needed. The police department can also provide more transparency, since police captured video can be processed more easily.

Video analytics tools can be useful in other contexts as well. They can automatically create transcripts of city council meetings, for example, complete with indexes that let citizens find the parts that interest them. Or think about a search-and-rescue operation, with drones scanning large sections of the ocean. AI software can examine that video for anomalies, such as the orange of a life jacket, helping direct rescuers to the best places to search.

Best of all, implementing this kind of service is straightforward: Microsoft provides pre-built models in Cognitive Services. Rather than creating your own models from scratch, you can use the ones that Microsoft already offers. In fact, Microsoft offers a demonstration website today (<https://www.videoindexer.ai>) that lets you see how easy it is to use these capabilities.

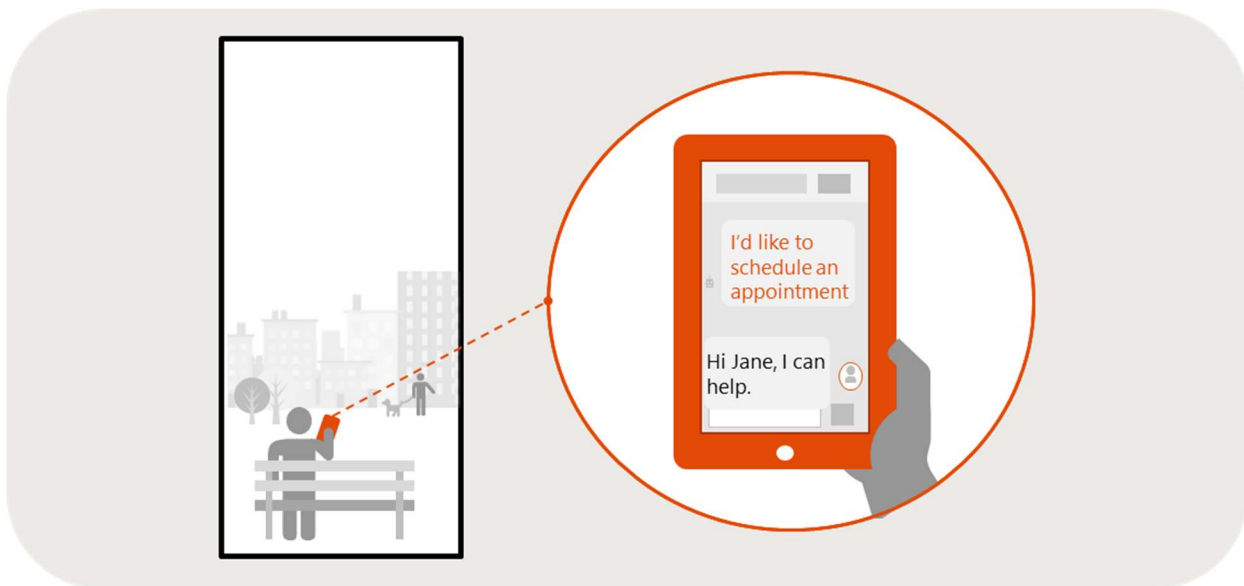
AI is transforming the way many organizations work with video. Why not make sure yours is one of them?

Making social services easier to use

How happy are most people with their government interactions? Much of the time, they're not as happy as we'd like. When a citizen needs to renew a driving license, for example, the process can require long waits and even multiple visits. When someone applies for a new social service, such as retirement benefits, he or she might face significant hurdles in simply making an appointment. And the truth is that business raises the bar for people's expectation of how they should interact with government. As businesses make this more agile, more consistent, and more efficient, so must government.

Once again, AI can help. One of the most broadly useful tools that AI makes possible is a digital assistant. Users interact with an assistant through their phones or laptops or another computer, and the experience is like interacting with another person. In fact, however, they're communicating with AI software: a digital assistant. The figure below shows an example.

Business raises the bar for people's expectations of how they should interact with government.



A citizen can rely on a digital assistant to help with tasks such as scheduling an appointment.

In this example, Jane is using her phone to make an appointment for a city service. When she needs help doing this, she interacts with a digital assistant. Jane can type questions just as if she were talking with a person. The digital assistant can then provide the help she needs by answering those questions, again in ordinary language.

Digital assistants let your organization provide better citizen service without hiring more people.

The benefits of this AI-enabled approach are easy to see. For one thing, they let your organization provide better citizen services without hiring more people, an essential need in most governments today. They also ensure a consistent level of service with consistent answers, something that's harder to do when different people are providing help.

Digital assistants are also useful in other scenarios. They can offer guidance in filing and paying taxes, for example, for getting information about benefits, and in many other situations. This is why they've become one of the most broadly applicable AI technologies in use today.

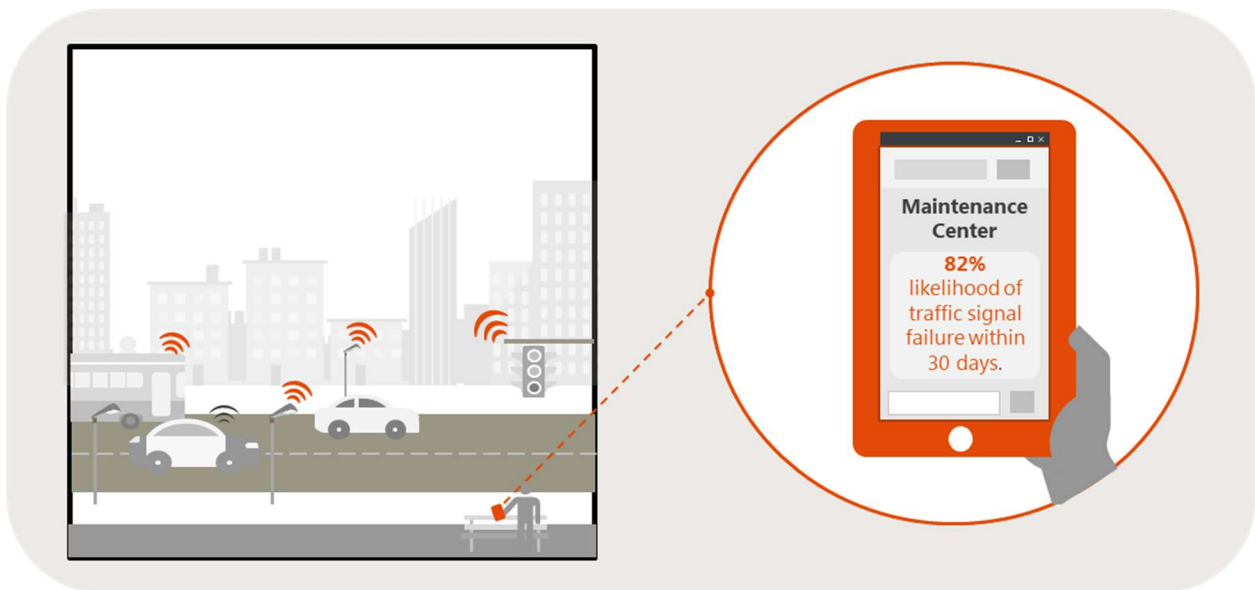
Microsoft technology makes these assistants significantly easier to build. Microsoft Cognitive Services provides pre-built models for many aspects of the process, including speech recognition. Microsoft also provides the Bot Framework, offering support for quickly creating digital assistants.

Digital assistants are becoming more and more common. (You might even have interacted with one without knowing it!) Given how broadly they can be used, the benefits they provide, and the simplicity of creation that Microsoft provides, this shouldn't be surprising.

Lowering maintenance costs in public transportation

Maintaining transportation infrastructure is expensive. Roads, buses, stoplights, and every other component must be kept in good working order, with as little downtime as possible. When things fail, as they inevitably will, you're left with unhappy citizens.

AI can improve this situation significantly. Remember what machine learning does: find patterns in existing data, then recognize those patterns when they appear again. If a transportation organization tracks and stores data about its various components, it can use machine learning to find patterns in that data. For example, the organization might find a pattern showing that whenever a stoplight sends a certain type of message three times within a week, it's likely to fail within the next month. The organization can use this knowledge to fix the stoplight before it breaks. The figure below shows how this looks.



Predictive maintenance lets you avoid problems by fixing things before they break.

In this example, sensors on stoplights, buses, and other components continually send messages about their status to a central computer. This computer then provides alerts to maintenance personnel through their phones. Here, a worker has received an alert indicating an 82% chance of a stoplight failing within 30 days. The worker can then make sure the light gets fixed before it breaks.

Predictive maintenance has many benefits. Doing maintenance on a component before it breaks can save money, since you're not forced to replace a broken component. Just as important, predictive maintenance

*Predictive
maintenance keeps
citizens happier.*

keeps citizens happier. Rather than deal with the effects of broken infrastructure, such as a failed stoplight, everything just keeps working.

AI can also be useful in other public transportation scenarios. Think about demand forecasting for bus routes, where past patterns can be used to predict how many buses are needed on each route. Some cities are also use AI to find patterns in traffic flows at busy intersections, then using this data to understand the predictors of collisions. Once they have this information, they can make the changes required to make these intersections safer.

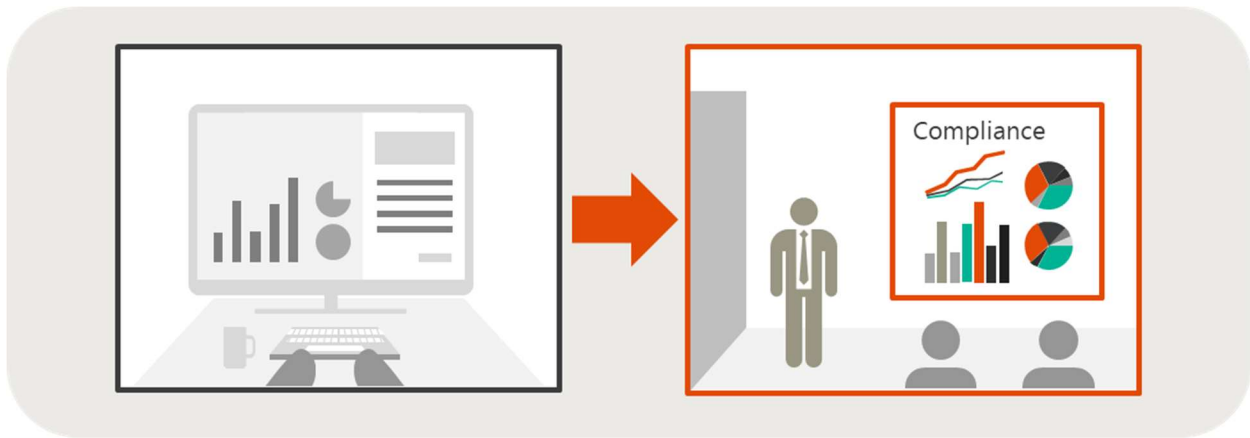
Microsoft tools can help you implement these scenarios. For predictive maintenance, you need to use your own information—it's not possible to create a pre-built model that works for everybody—but Microsoft does offer foundation models for you to build on.

AI is a general-purpose technology, and machine learning can be applied in many areas. Improving the reliability and safety of public transportation while lowering costs is an important example of what's possible.

Increasing tax compliance

Whenever a government is getting or giving away money, there's an opportunity for fraud. Perhaps the most important example of this is tax fraud. This crime has many forms—taking unallowed deductions, not declaring income, and more—and improving a government's ability to detect any of these has real value towards increasing tax compliance with taxpayers.

Once again, AI can help. Tax fraud often occurs in predictable ways, i.e., there are patterns. Using machine learning, a tax organization can find these patterns, then use them to detect fraud in the future. The diagram below illustrates this idea.



Using machine learning to analyze tax returns can find fraud and improve compliance.

Working with others, a data scientist can create a model that recognizes patterns of tax fraud. For example, maybe people who take four specific deductions are much more likely to under-report their income. By applying the model to the tax returns of every taxpayer, the tax organization can quickly determine which ones require more scrutiny. The benefit is clear: better compliance and more revenue.

There are many other examples as well. If a country's tax organization has access to consumption data, for example, the data scientist might look for patterns such as low reported income combined with multiple first-class airfares or other anomalies. The point is that tax fraud often occurs in patterns; you can use machine learning to find these patterns.

Doing this takes some work, however, because Microsoft doesn't supply a pre-built model. (How could it? Every tax administration has different data.) Instead, you need to work with tools such as Azure Machine Learning Studio and a data scientist to create your own. While this requires more effort, it can also offer a great deal of value.

Tax evasion is an ongoing problem. AI can help you beat tax cheats and increase tax compliance.

Tax fraud often occurs in patterns; you can use machine learning to find these patterns.

The ethics of AI

We're at an inflection point with AI, and there are great opportunities ahead for empowering people and organizations in new ways. Yet like many technologies, AI raises ethical questions. Here are some of the concerns that often come up:

Technology improves productivity, letting us deploy people where they can provide more value.

- *How will AI impact my staff?* Technology improves productivity, letting us deploy people where they can provide more value. And in many cases, AI is a complement to existing workers, making their work more effective. (Most of the scenarios described in this paper do this.) And in many governments, workers are retiring faster than they're being replaced. AI solutions can help fill this gap.
- *What happens if a machine learning model is created using biased data?* Recall that a model's ability to recognize patterns depends entirely on the data used to create that model. If this data is biased—maybe it omits a class of taxpayers, for example, or was compiled from racially biased practices—the result from using this model will also be biased. Avoiding this is an essential aspect of using AI, and the best solution is to be aware of the potential problem, then take steps to avoid it. (This is especially true when you're creating your own models rather than using pre-built models from Microsoft.) Still, the flip side is also true: A high-quality, unbiased model that gets widely used can create positive change very quickly.
- *Who's responsible for problems with a model?* What if, despite your best efforts, a biased model gets used? Who's responsible? Machine learning can make it hard to delineate responsibilities. Does the fault lie with the person who brought AI into your organization? The people who provided the data from which the model was built? The data scientist who created the model? His or her manager? It can be hard to pinpoint where the failure occurred. Yet to use AI successfully, your organization must be willing to address challenges like these—there's no way around it.

In many ways, the ethics of AI are analogous to those of medical science. In medicine, ethics committees have created rules that, for example, limit experimentation on people. Similar rules are emerging for AI, setting limits on whether an application meets ethics guidelines. In fact, government has an important role to play here, such as proposing ethical guidelines to make sure AI is beneficial for society as a whole.

AI has some downsides, but for most, they're outweighed by the benefits.

AI has some downsides, but for most, they're outweighed by the benefits. Still, expect to have quite a few conversations about AI ethics with a variety of people in your organization. The topics those conversations should cover include fairness, reliability and safety, privacy and security, inclusiveness, transparency, and accountability. All these areas are important and working out how to address these concerns in your

organization is essential. The truth is that machine learning and other aspects of AI exist: There's no going back.

AI as a Recruiting Tool

Many governments have been laggards in adopting new technology. There are good reasons for this, such as the need to adhere to fair—and often slow—procurement practices. But not using up-to-date technology can make it harder to attract and retain talent, especially younger people.

Adopting AI in any capacity can help with this. Seeing that a government agency is willing to work with leading edge, innovative technologies can help you attract high-quality people to your organization. The value of AI doesn't lie solely in how it improves your mission; it's also a valuable tool in recruiting new staff.

What to do now

The reality is clear: AI can help your organization better meet its goals. Using the pre-built models provided by Microsoft Cognitive Services, you can achieve these goals quickly—getting value from AI needn't be a year-long project. And when you need to create your own models, Microsoft tools such as Azure Machine Learning Studio can help you do this quickly and efficiently.

AI isn't some far-off futuristic technology; it's here today.

AI isn't some far-off futuristic technology; it's here today. The question you should be asking isn't *if* your organization should embrace AI. It's *when* and *how* you'll put this powerful technology to work. Choose a problem that's right for your organization, then get started now.

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