We Are AI: Taking control of technology
We are AI #1: “What is AI?”

Cover-alt

A collage of different forms of AI (from left to right) - a collection of diverse faces of different skin tones and ethnicities (depicting the targets of facial recognition software), embodied robots smiling and chatting over a round of drinks, three chess pieces – the king, the queen and the horse – and a chess board (symbolizing the historic breakthrough in game-playing AI), the steering wheel of a self-driving car, a typewriter generating text from a mystical language (depicting language models), a flurry of notifications from different social media apps, and two self-driving drones flying around. A big question mark lies in the middle of this collage, pondering the motivating question of this volume: What is AI?

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Mo, our protagonist, is an African-American woman, with glowing ebony skin and dark curly hair, dressed in a vibrant green sweater. Mo throws her hands in the air, as she exclaims-
Artificial Intelligence (AI) is great!

The convergence of unprecedented data collection capabilities, and enormous computational power, and the appetite to use them to move society forward, is truly magical!

The potential for good seems limitless –

Mo overlooks a robot looking at a petri dish under a microscope

We can accelerate scientific discovery

- from medicine to astrophysics and back

We can boost innovation - from self-driving cars to personalized ads and recommendations.

The bot hovers in the air, projecting holograms of different advertisements and product recommendations for Mo

We can improve society – by improving how governments function - making their operations more transparent and accountable, and their resource distribution decisions more equitable.

And perhaps, the best of all – we can get AI to do all our work, so we can just kick our feet up and relax at the beach.

Experiment Complete

We see Mo sitting on a lounge chair, while the bot hovers in front of her projecting a holographic screen with the results of scientific experiments.

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But before we rejoice at the possibilities, let's step back and unpack that term, AI.

Here's a throwback to the prehistoric days of early 2020.

Remember the hobby that many of us attempted to master – with mixed results – during the pandemic lockdown – Baking!

Our protagonist Mo, is in a pink apron and is proudly pointing to the plate of scrumptious loaves – fresh from the oven – that she holds in her other hand.

We will use baking to explain three components of AI: algorithms, data, and decisions.

Consider this 'algorithm':

A recipe book lies open, facing the reader. The picture of a perfectly golden loaf of bread, plated with a stem of rosemary and plated on a ceramic black plate, is on the left. The steps of the recipe are on the right.

prep - buy ingredients, measure them

mix - combine yeast, flour and water

cover, wait for the dough to rise

knead: shape, wait some more, repeat

finally, bake

The recipe is the algorithm: it lists the steps we take to transform the ingredients into a loaf of bread.

Akin to how we each have our own cooking styles; algorithms are of different types…

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The algorithm may be fully prescribed:

it may list exactly what ingredients to get,

Mo places all the necessary ingredients on the kitchen counter – eggs, flour, butter, salt, yeast, etc.

exactly how much of each ingredient to take,

Mo is hawk-eyed in measuring the amount of flour to use – her eyes are razor sharp, her tongue is out, and her finger is pointing to the gradations of the measuring jar.

in what order to combine them,

Mo smiles as she slowly mixes milk into the dry batter in the bowl.

how long to wait,

and at what temperature to bake.

Mo opens the oven door and places the dough in.

We call such algorithms “rule-based”.

If we know the rules well enough to write them down, and if we can always get exactly the same ingredients, then we will bake a great loaf of sourdough every time!

Mo is in her pink apron and a large chef’s hat, and blows a chef’s kiss to the loaf of bread she just baked.

But we may not always be so lucky.

We may only have ever eaten delicious sourdough, but may not know the rules for making a good loaf ourselves. So, instead of relying on our own everyday experience to design rules, we can have the algorithm learn these rules from data.

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We call such algorithms ‘data-driven’

We see Mo stuffing mini-rolls into her mouth from a plate in front of her. An arrow leads from that picture to a recipe book with the page for how to make the bread.

They learn the recipe to bake sourdough from our experience of what good sourdough tastes like.

How does this work?

We have some vague idea of what ingredients go into a loaf,

Mo throws ingredients into a bowl and rapidly stirs them

and have several data points of experience of what it's supposed to taste like, and so we go about trying different combinations of the ingredients and cooking techniques.

Mo tries different kneading techniques – once the good ol' way with her hands, the other by spatchcocking the dough with a rolling pin!

Each time we make a loaf we ask ourselves – do we like how the sourdough came out?
We see Mo in the view of an open oven door– her loaf looks burnt and so she is throwing her hands up in exasperation.

If so, we may keep this recipe, or maybe we'll try something slightly different. Or a lot different, and see which result we like better.

From this we can figure out which culinary sorcery produces the yummiest results
– closest to what we remember a good loaf tastes like.

Mo holds up a loaf of bread she has just baked in celebration.

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We discussed the algorithms, now what about the data?

It comes in multiple forms.

One form is: the combinations of ingredients we take as input.

We see an assortment of cooking equipment in Mo's kitchen – different bowls and cups, measuring spoons, spatulas, brushes and rolling pins.

Another is the parameters of your equipment, such as oven temperatures and wait times.

We also get a glimpse at Mo's high-tech oven, and the scores of loaves that it produces

And then there is data that describes the output – that scrumptious sourdough that we remember demolishing and are hoping to bake ourselves!

Mo holds up a measuring tape to a loaf of bread, taking down the precise measurements of its height, width and breadth.

What is its nutritional value?
How much does it weigh?
How chewy is the center?
How well-done is the crust?

These are all 'objectively' measurable factors.

We see a slice of freshly baked bread – a calorie counter outputs it's nutritional value at 32cals, while the colors of the crust and center of the bread is measures to colors on a "bread-pallette", and the texture of the loaf is measured by zooming into the slice and gauging the consistency.

Then there's data in the form of human judgment -
Did the loaf come out well or not?
Does it look good?
Is it tasty?

This is the 'subjective' feedback we get about the output.

And, more often than not, it's more important than the numerically-quantifiable properties of the output.
We see Mo drawn as the food critic from the lovely Pixar film "Ratatouille", as she takes a bite of bread, and it takes her back to memories of her mother's artisan bread from her childhood, and she scribbles down her review on the notepad at her side.

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Now, what about decisions?

After every run of our baking algorithm, a human is making a decision -
Does the dough look good enough to put into the oven?
Has the loaf risen enough and shall we take it out of the oven?
Is the result Instagram-worthy?
Are we giving it a thumbs-up or a thumbs-down?

Mo continues to be drawn as the food critic from "Ratatouille" – she's being her own worst critic right now, contemplating the outcome of each of her baking sessions. We see a thought bubble appear over her, as she pictures herself in France, wearing a chic berette, and posing with a handful of baguettes – thumbs up and thumbs down emojis appear in her contemplation about the loaf.

A consequential decision is - now that we've tried a bunch of recipes, which will we consider a success?

A bunch of robot-arms feed Mo slices of bread that they have conjured up

Is it more important to have an appetizing-looking loaf…or one that consistently comes out chewy on the inside and crusty on the outside?

An even more important decision is - do we think that we've tried out enough recipes to pass our experience on to a machine, and trust it to bake -- and make judgments -- on our behalf?

A bunch of human arms feed a baker-AI/robot slices of bread that they have conjured up

Can we trust that same machine to bake something different, like baguettes?

And who must pack up their knives and go home if the baguettes are an utter failure?

Several moral questions around agency, autonomy and responsibility naturally emerge!

We see a sort-of cyborg-Mo, where a series of robot arms extend out of her back, resembling the Hindu goddess Durga. Mo holds two loaves of bread in her (human) hands, while her robotic arms holds an assortment of cooking equipment such as a timer, a sieve, a rolling-pin, a spatula, etc.

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Circling back now – so what is AI?

AI can be characterized as a system in which algorithms use data to make decisions on our behalf, or to help us - humans - make decisions.

An example of AI is Roomba – the robot that helps us clean.

Picture a cute little Roomba – it is circular in shape, and a stylish black-gray in color.

Roomba is great at autonomously vacuuming the floor,

and is one of the victories of classical — rule-based — AI.

It’s the stuff of textbooks.

The decisions a Roomba makes are —
How should it map out a room (that it may have never seen before)?
What’s an efficient strategy to clean?
and what is its next move: go left, go right or turn around?

We see the Roomba trying to navigate through the door of the room, it bumps into the exterior walls a few times, but at last is able to map out a clear path, and trots ahead, through the door.
Another example of highly successful AI is IBM's Deep Blue that beat Garry Kasparov, the legendary grandmaster, at chess in 1997.

This success in games, and at learning from self-play, is one of the holy grails of AI.
In an intense scene of inter-species battle, we see Gary Karpsarov hunched over a chess set, his finger in the dimple of his chin, expression stern and deep in thought. Across him sits an embodied robot – IBM's historic Deep Blue game-playing AI – staring at the board and computing its next move.

The decisions in chess are more complex than in Roomba, but they are similar in that they are strategic:
What's the best next move?
What's a good overall strategy to take?
And how must we effectively respond to the decisions of the opponent?

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But now consider another increasingly popular application of AI:
its use in hiring.
The decisions that we are asking an AI to make here are very different from those made by Roomba and by Deep Blue.

We are asking it to predict who will do well on the job and who will fail.

The big question is:
Can an AI succeed at tasks – like hiring - that amount to predicting social outcomes?

We see three applicants sitting for a job interview in front of a Robotic-HR/ an automated hiring tool. From left to right, there's a small Asian man with dark hair, in a simple blue shirt smiling nervously at the robot; a Caucasian man with blond hair in a dapper suit, with a laptop open in front of him, grinning confidently at the robot; and a Caucasian woman with dark red hair, in a purple formal blouse, sitting with her hands on the table, smiling politely at the robotic-interviewer.

How do we measure success?
Can we know whether we did hire the best candidates?
And do we want an AI to be making such predictions in the first place?
Do we consider this to be ethical?
Even with all of our intuition, we, humans, are notoriously bad at making big decisions.
Why would we expect an algorithm to be able to take a whiff of our past and be able to predict the future?

There is no secret sauce or magic beans that innately makes AI more ‘accurate’ or ‘equitable’ or ‘fair’ than its human predecessors.

As our friends Serge Abiteboul and Gilles Dowek say [1]:
Creations of the human spirit, algorithms are what we make them!
And they will be what we want them to be: it’s up to us to choose the world we want to live in.
We see a caricatured Serge Abiteboul holding one of the components of a nearly-assembled robot and smiling knowingly at the viewer. To his left is a caricatured Gilles Dowek, smiling and giving the viewer a “thumbs-up” sign.

[1] Serge Abiteboul and Gilles Dowek (2020). The Age of Algorithms