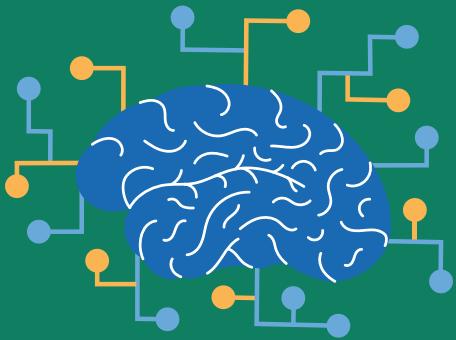


# BU AND BO DISCOVER MACHINE LEARNING



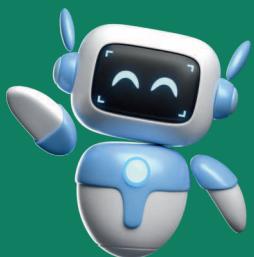
by: Yafet Hailu



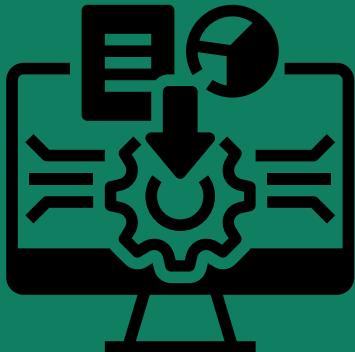
Hey guys! My name is Bu, and right next to me is my amazing friend friend Bo. We are here to show you all the amazing things about machine learning with the help of our smart and friendly robot, Robo!" Robo loves machine learning. He will be our guide throughout this adventure. We'll have fun along the way so get ready and comfy!



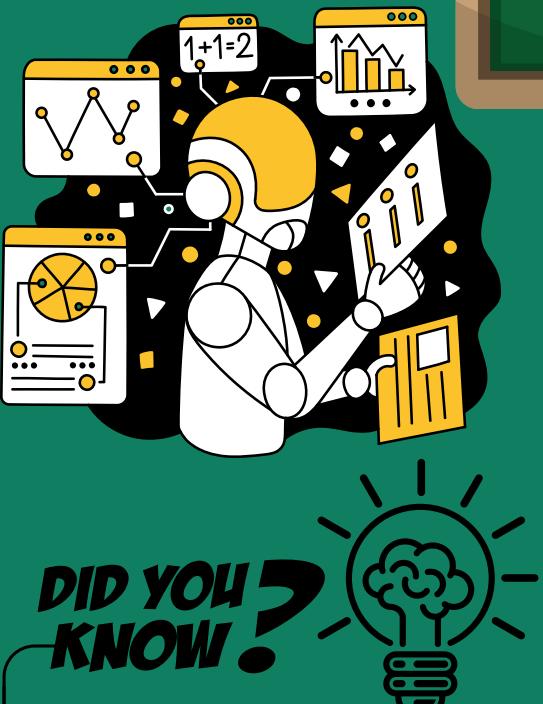
Hey guys!  
Let's go on an adventure to discover how I learn and use machine learning to do cool things!



First up we will learn what Machine learning means.  
Then, we will go the machine learning factory with Robo to get him ready for our journey.



Machine learning is a way for computers and robots, like me, to train and learn how to process information. It trains computers how to predict, solve and process things and patterns around us. It's like how you learn to ride a bike or play a game. You practice, make mistakes, and get better. Just like you learn from your teacher or your parents, machine learning trains computers to learn from data.



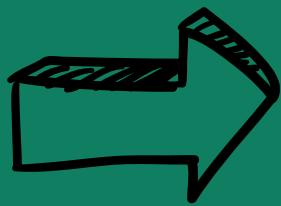
**DID YOU KNOW?**

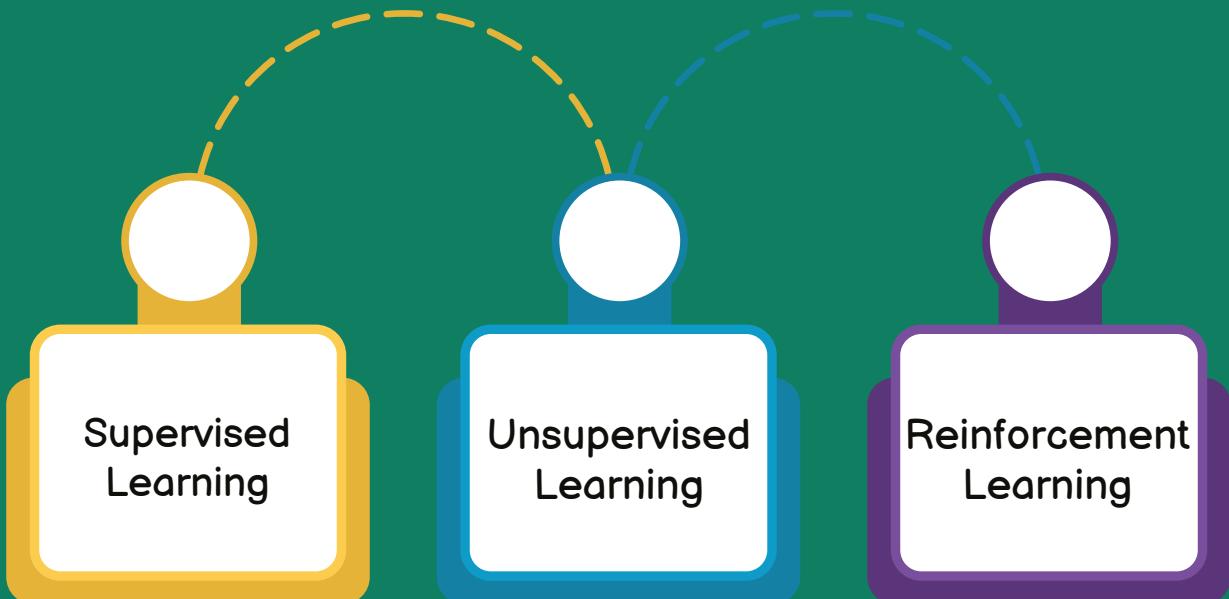
Machine learning, does not tell the computer what to do. It teaches the computer how to decide and solve problems by giving it a lot of examples to train on.

INTERESTING FACT

For example, if I see lots of pictures of cats and dogs, I can train using that information and tell the difference between them by noticing things like fur, ears, and tails. I can use the data to identify other cats and dogs.

Types of Machine Learning

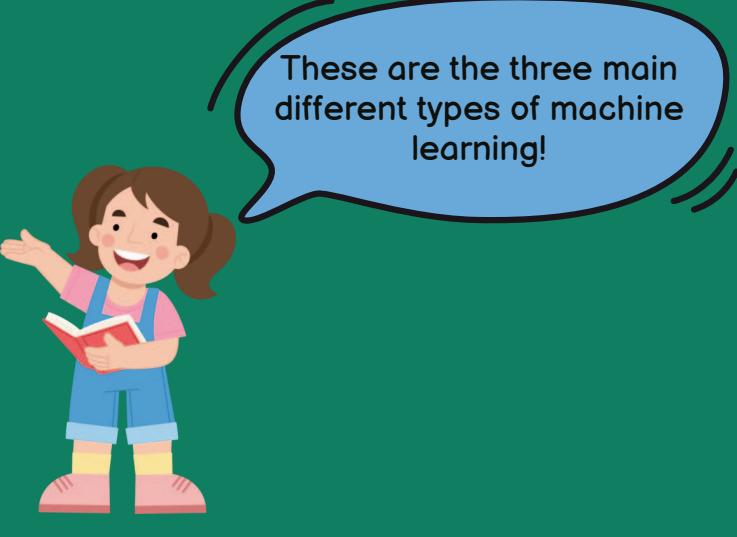




Supervised  
Learning

Unsupervised  
Learning

Reinforcement  
Learning



These are the three main  
different types of machine  
learning!

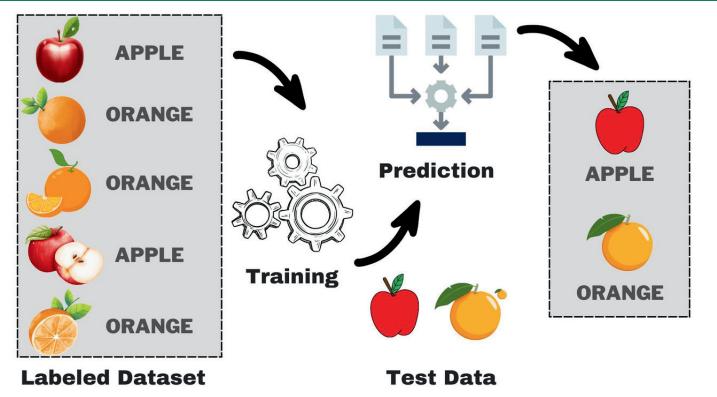


It's me Bo  
again! It was so  
nice to meet  
you :)



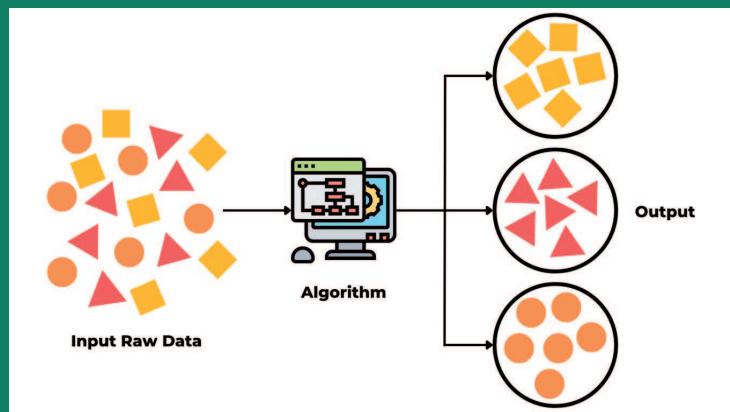
### Supervised Learning

The computer is shown lots of examples with the correct answers, and it learns how to make predictions on new examples.



### Unsupervised Learning

The computer looks at data with no correct answers and tries to find patterns and groups on its own by analyzing available data and grouping information based on similarities and differences to create relationships in data.



### Reinforcement Learning

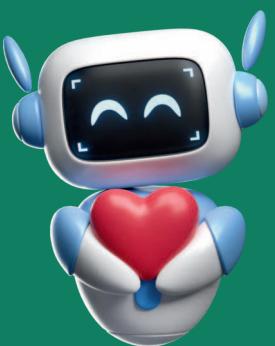
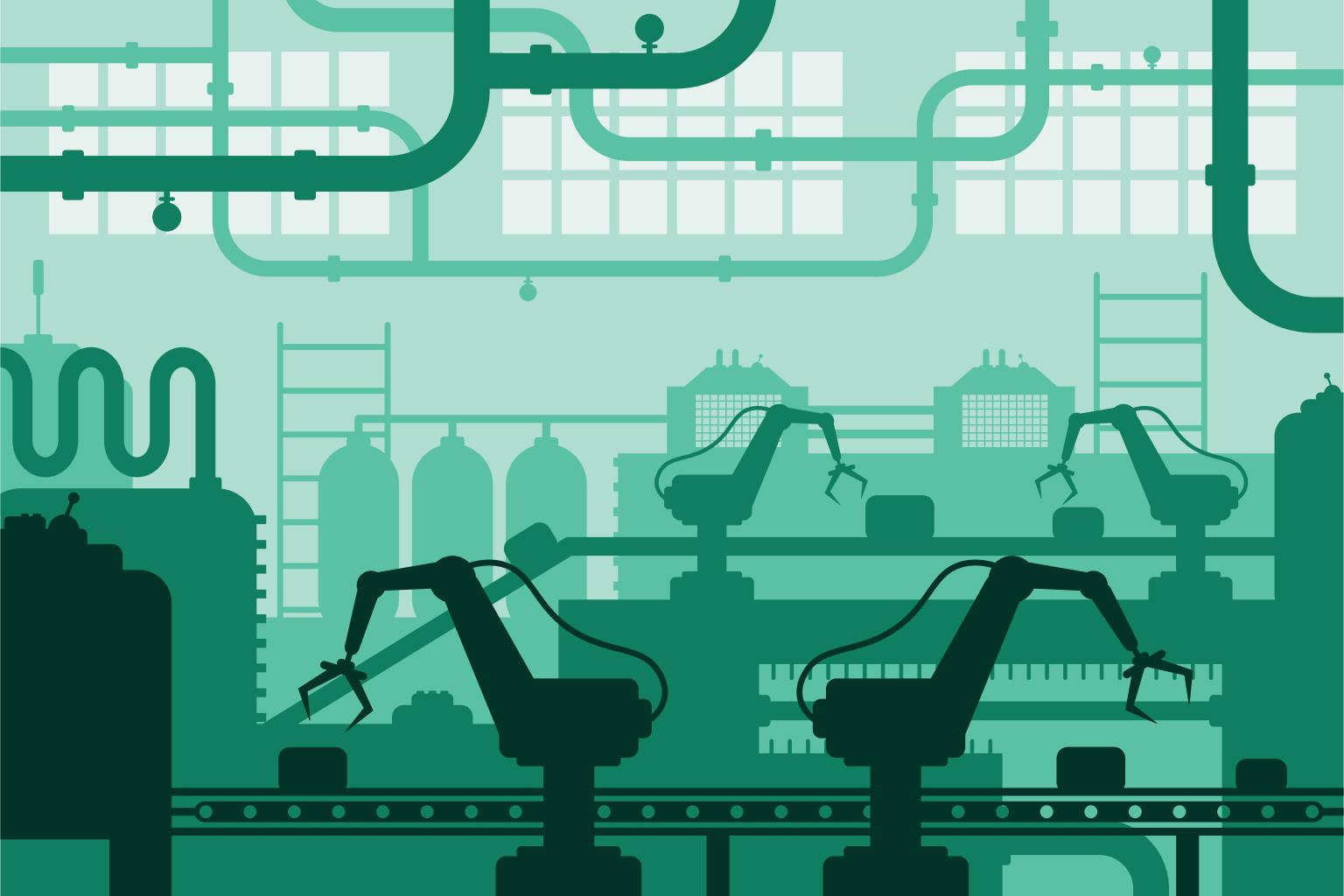
The computer takes actions and receives rewards or penalties, so it learns which actions lead to the best outcomes. It does not have the answers like in supervised learning so the computer learns from experience.

### Agent



### Environment



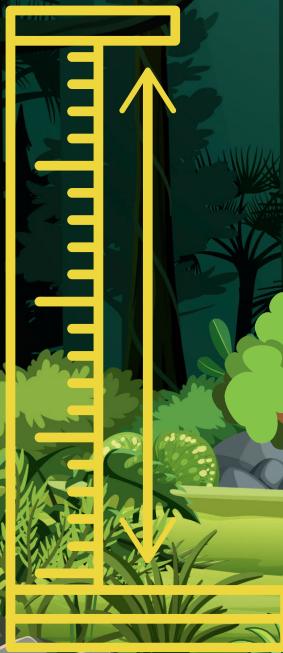


We have arrived favorite place--the machine learning factory!  
This is where I train to do machine learning, and I can't wait to  
show you all the cool things we can learn together!  
After I finish training and become good at using machine  
learning, we will start our adventure around the country and  
teach everyone the tools of machine learning and how to use  
them.

A colorful illustration of a jungle environment. In the upper left, a brown monkey hangs from a green vine, holding a yellow banana. In the center, a red and blue parrot flies towards the right. On the right side, a green and yellow striped snake coils around a tree trunk. In the bottom right corner, a small green frog sits on a rock. The foreground shows a patch of brown dirt with some small plants and rocks. The background is filled with dark green trees and palm fronds.

# DESTINATION 1: THE FOREST

## Trees' Ages



Of course Bo! I will first can the height and age of the trees.



2

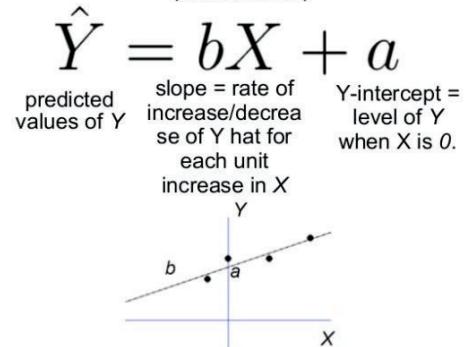
3

5

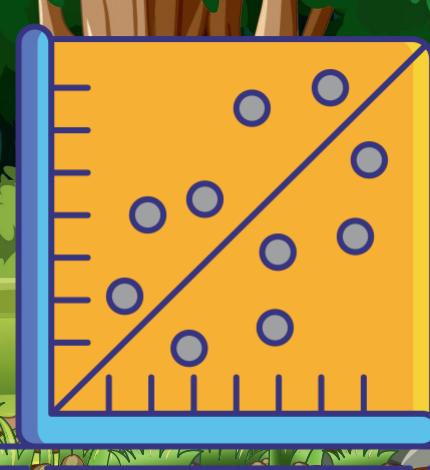
8

Robo, here we have trees of different sizes and ages. Can you predict how tall a tree will grow based on its age?

## Linear regression equation (without error)



I will use the machine learning tool called linear regression. And this graph next to me is a linear regression graph. By looking at the ages and heights of the trees, I will apply the math equation you see above. The equation will give me information I can use to draw a line that helps me predict how tall a tree will be as it gets older.

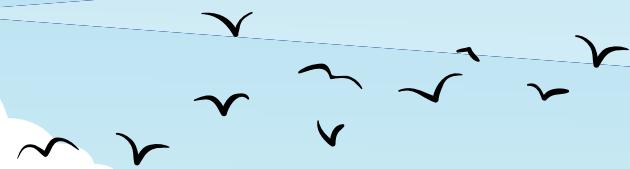
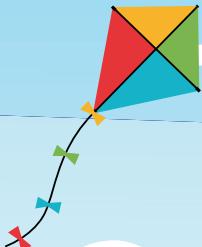


Linear means 'in a straight line.' The circles on the screen are data points, which show the height and age of different trees. The straight line that goes through them is what we call a linear regression line. This line fits the data points into a linear equation, which helps me predict the height of a tree at any given age. It helps me understand how one thing changes when the other thing changes. In this case, the line shows the pattern and helps me make predictions about new trees I haven't seen before.



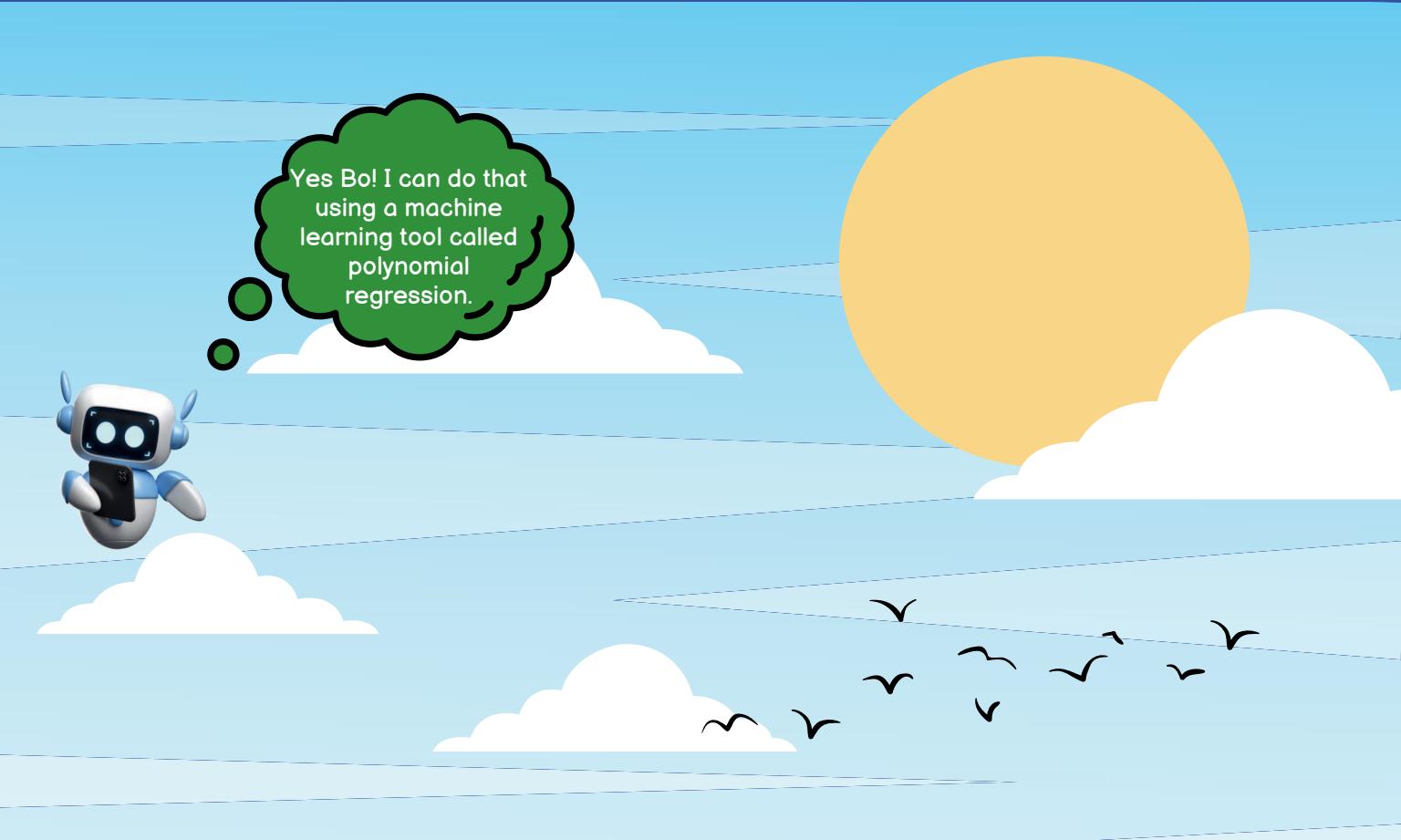
# DESTINATION 2: THE PARK





Weewoo! It is hot out here. Hey Robo, while we play around, can you predict how many ice creams will be sold today?





Yes Bo! I can do that using a machine learning tool called polynomial regression.



- **Polynomial regression** is a statistical technique used to model the relationship between variables when the data shows a non-linear pattern. Unlike linear regression, which fits a straight line, polynomial regression fits a curved line by including higher-order terms like  $x^2x^2x^2$  and  $x^3x^3x^3$ .

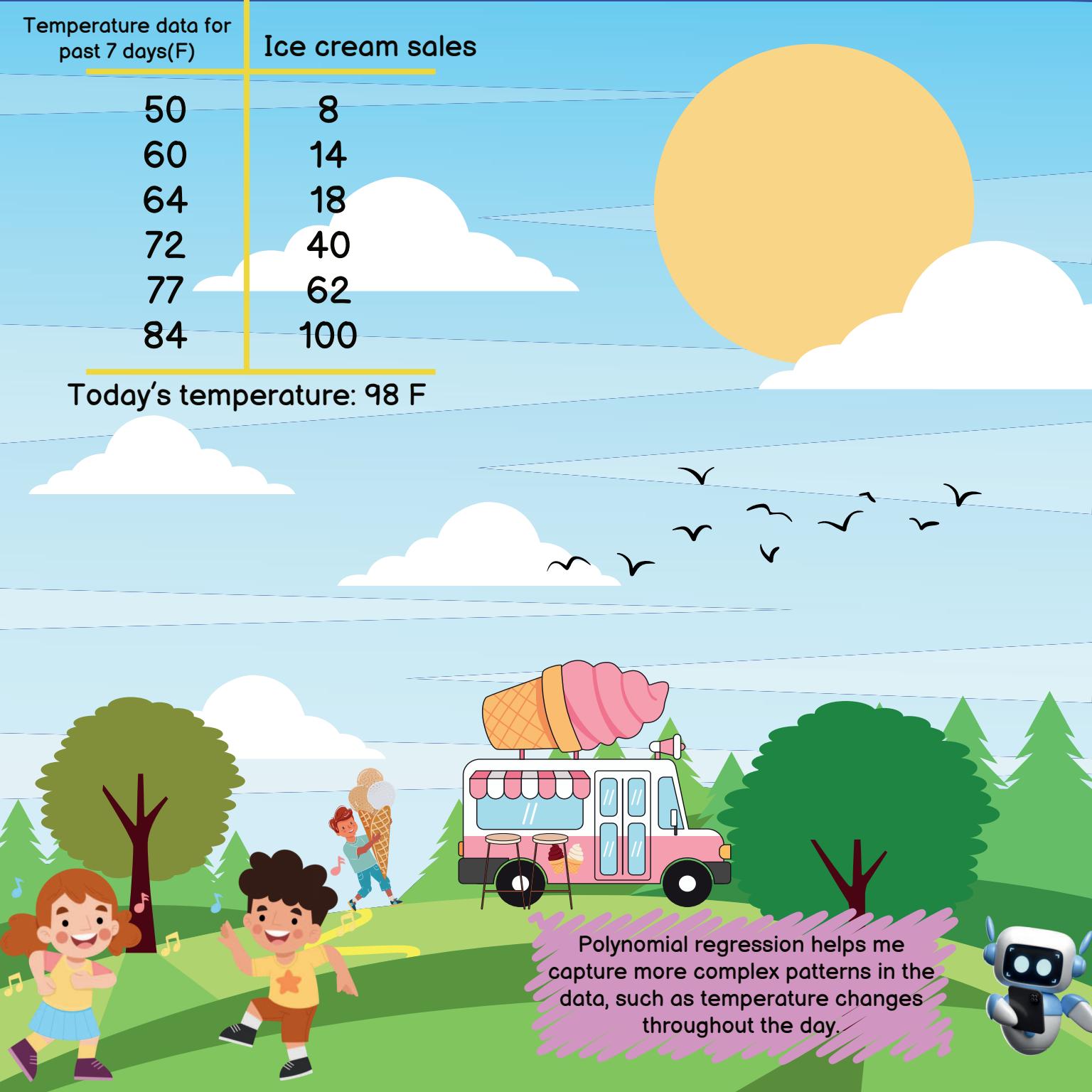


Temperature data for  
past 7 days(F)

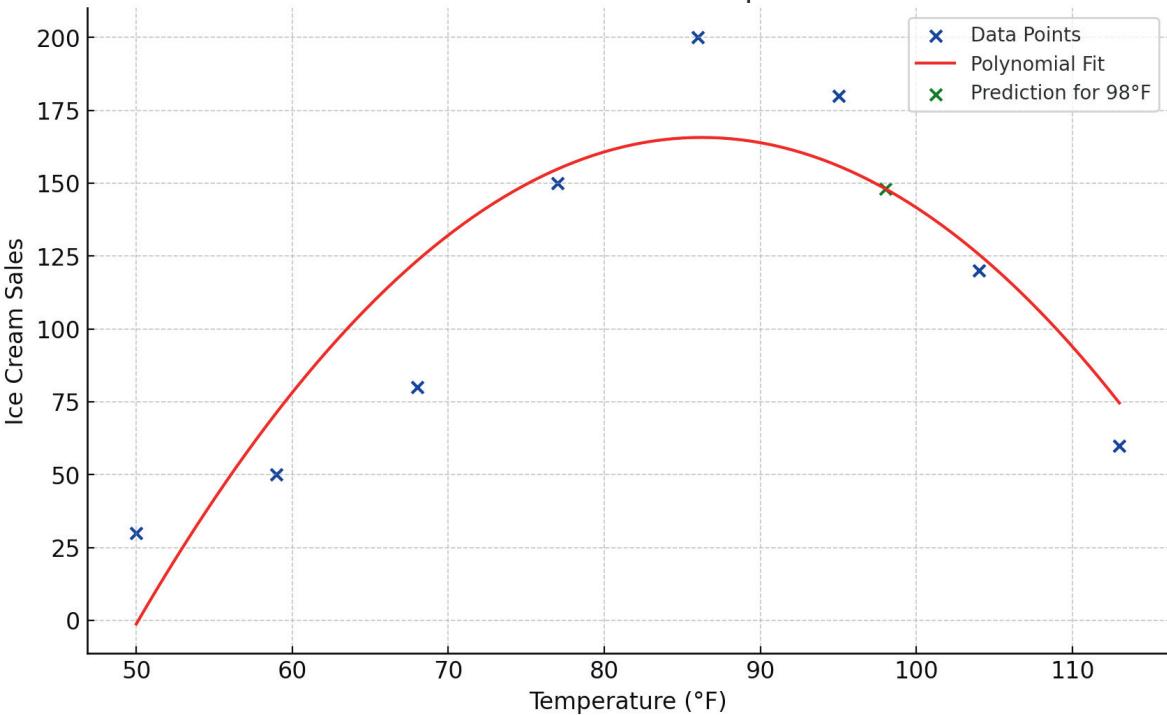
### Ice cream sales

50	8
60	14
64	18
72	40
77	62
84	100

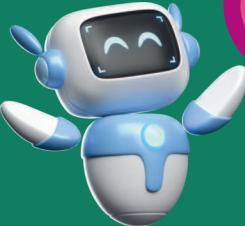
Today's temperature: 98 F

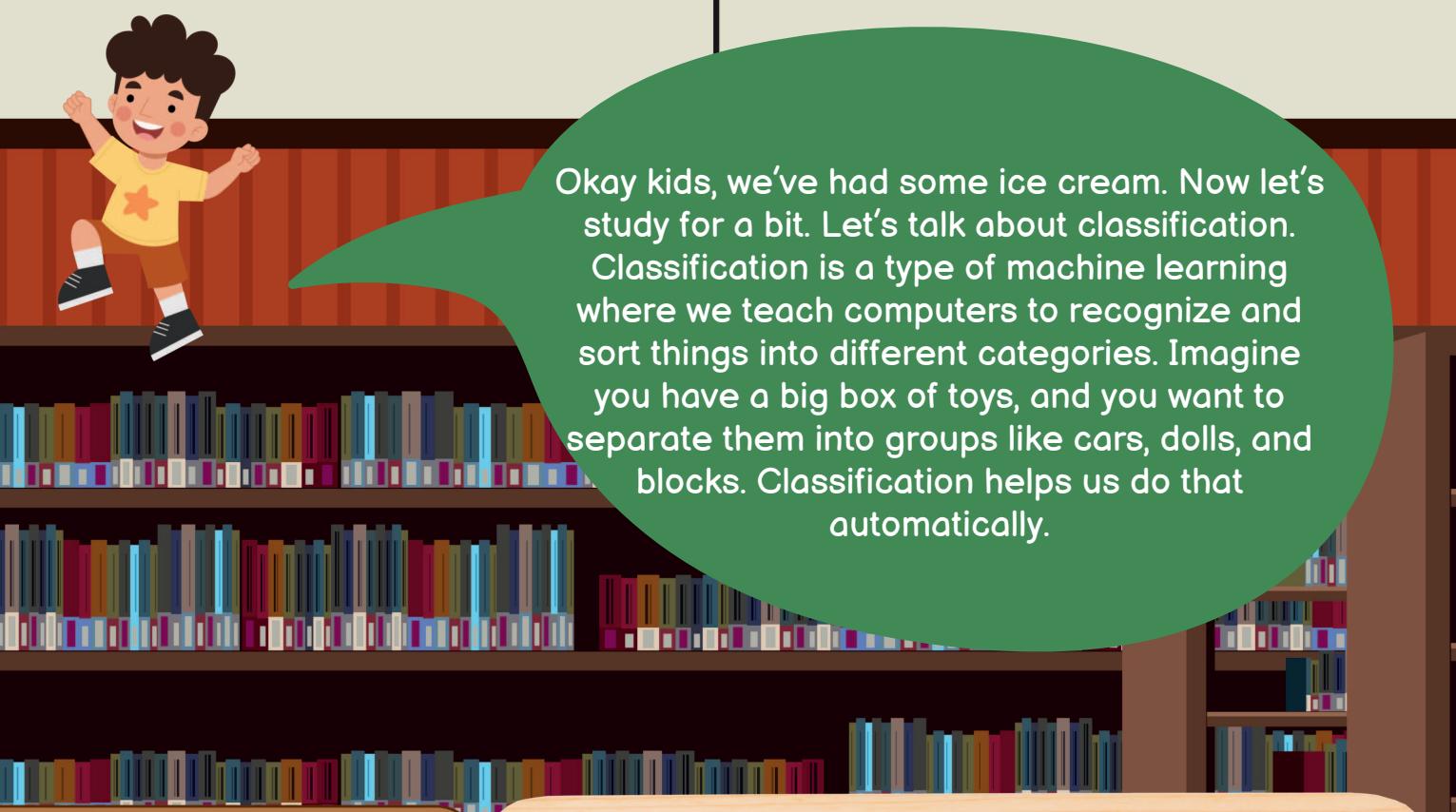


## Ice Cream Sales vs Temperature



By looking at ice cream sales at different temperatures from seven sample days with different average temperatures, I drew a curved line that better fits the ups and downs of the sales. When it's too cold or too hot, fewer ice creams are sold, but in between, more ice creams are sold. The curved line shows this pattern. I used this to predict 148 icecreams to be sold today.





Okay kids, we've had some ice cream. Now let's study for a bit. Let's talk about classification. Classification is a type of machine learning where we teach computers to recognize and sort things into different categories. Imagine you have a big box of toys, and you want to separate them into groups like cars, dolls, and blocks. Classification helps us do that automatically.



To create a classification system, we first collect lots of examples of the things we want to sort. For instance, if we want to classify animals, we gather many pictures of different animals. Then, we use these pictures to train a machine learning model. The model learns what features each group has in common. For example, it might learn that tigers have stripes, bears have fur, and elephants are very large.

Once the model is trained, it can look at new pictures and decide which group they belong to based on what it has learned. This process helps us quickly and accurately sort and identify things, whether they are animals, plants, or even types of fruit!

Now, let's go to Eddie's farm with Robo and try this out!

# DESTINATION 3: EDDIE'S FARM





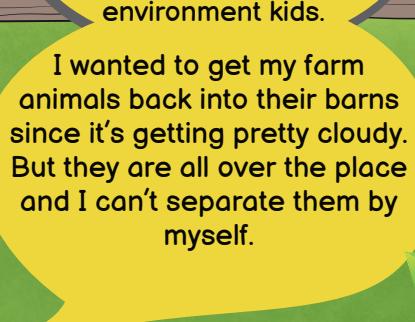
Hi farmer Eddie! My friends and I wanted to visit your farm to clean up and plant some trees.



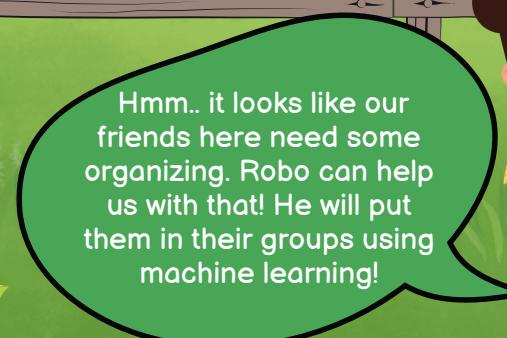
Collecting  
data...



Boy am I glad to see you!  
You made my farm look  
beautiful. It is important we  
take care of our  
environment kids.

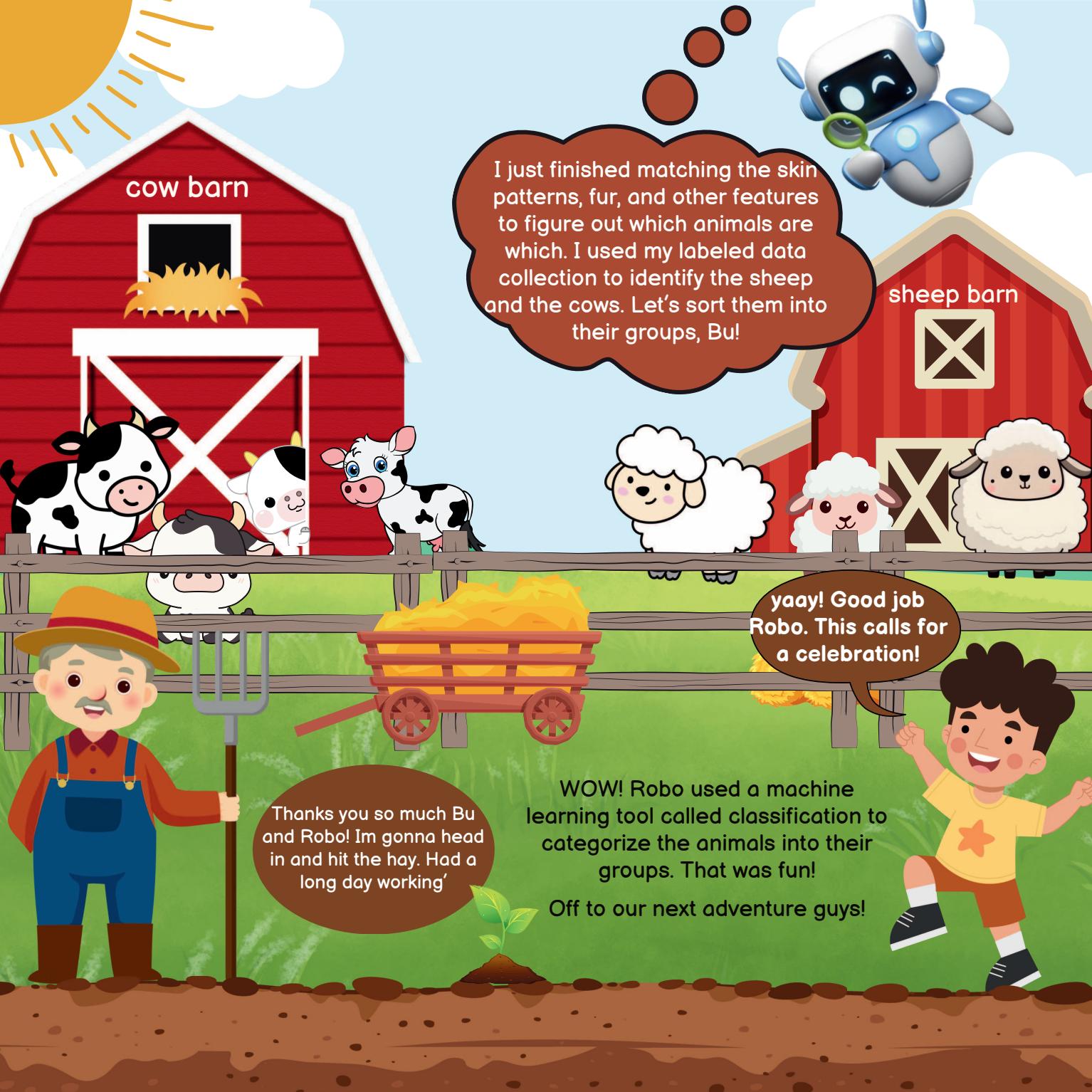


I wanted to get my farm  
animals back into their barns  
since it's getting pretty cloudy.  
But they are all over the place  
and I can't separate them by  
myself.



Hmm.. it looks like our  
friends here need some  
organizing. Robo can help  
us with that! He will put  
them in their groups using  
machine learning!







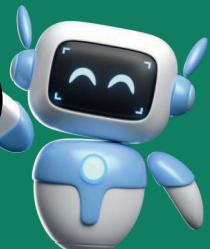
Hey Robo. We will shows you some pictures of our friends and you will try to identify them at the playground.



Pss.. hey Bu, I have an idea. Let's show Robo pictures of all our friends and see if he can identify them.



I'd love to Bo. I will use the machine learning tool called neural network to do it. I will shows you and our friends how that works. Come with me. But first I have to scan their pictures to collect features.



bzzzt bzzzt scanning  
scanning....

# Neural Network

Imagine you have a big puzzle to solve, but you don't know how to do it. You decide to ask your friends for help. Each friend knows a little bit about the puzzle, like how to put together the corners or the edges.

A neural network is like a big team of friends helping each other solve puzzles. But instead of puzzles, they solve problems like figuring out what's in a picture or what words mean. Each friend in the neural network is called a neuron, and they work together to solve the problem.

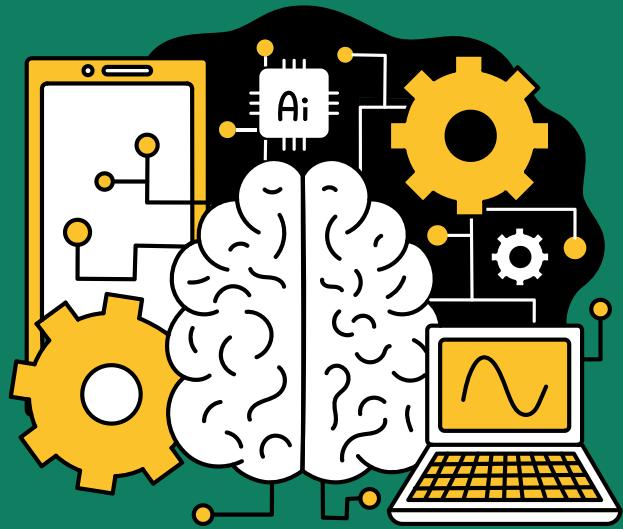
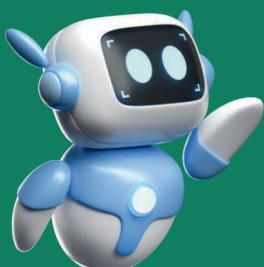
Neurons are connected to each other, just like friends holding hands. They pass information to each other until they figure out the answer. Sometimes they make mistakes, but they learn from them and get better at solving problems over time.

So, a neural network is like a big team of friends working together to solve tricky problems, just like you do with your friends when you're trying to solve a puzzle!

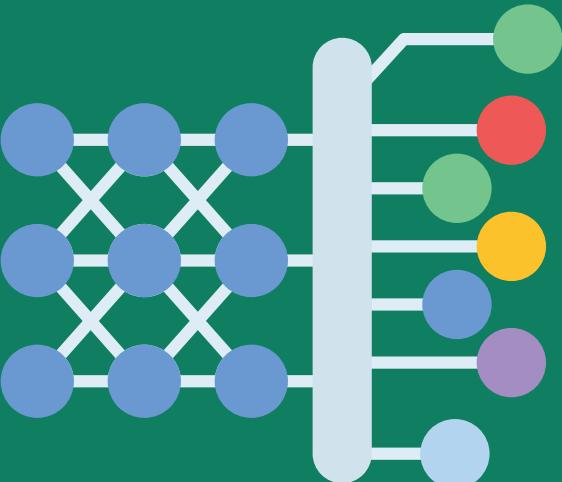


This is what a neural network graph looks like. Pretty complicated looking, right?

Don't worry, each dot represents some data that I will use to solve a problem. The lines between them are what form the 'network' part. It forms the relationship between the features.



Neural networks are a popular and very powerful technique for building Machine learning systems. Their structure is based on the structure of our brains, with the different parts called neurons, arranged in layers that are connected together.



# DESTINATION 3: THE PLAYGROUND

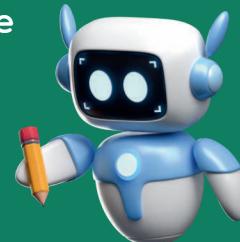




## Neural networks have layers that are similar to the graph you saw in the previous page on neural network.

**Input layer:** The neural network receives input data, such as images of faces or audio recordings of voices, through its input layer. Each neuron here represents a feature of the input data, like appearance or behavior..

Let's walk through the steps of how I use neural networks.



**Hidden layer:** The input data is processed through one or more hidden layers of neurons. Each neuron here applies a mathematical function to those inputs, and passes the result to the next layer. These hidden layers help the neural network learn complex patterns and relationships in the data.

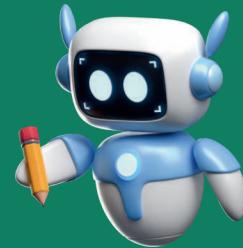
**Output layer:** The processed data that flows from the hidden layers comes here. The neurons here produce the final result, which could be a classification (e.g., identifying a friend's face) or a prediction (e.g., recognizing a friend's voice). The neural network compares the output to the desired outcome and adjusts its internal parameters during training to minimize errors.



Using the data of facial features I collected from the pictures Bo showed me, I will input the faces of our friends one by one. I will then use the neural network to identify who is who. How do you think the neural network knows that kids?

Each picture is labeled with the friend's name, so the neural network learns to recognize different features.

For example, it learns the shape of their eyes, the distance between their nose and mouth, and other unique features.

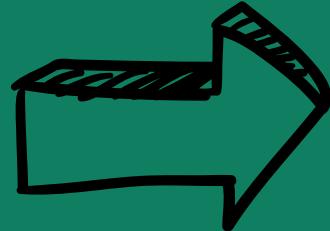


When I see a new picture, I pass it through the neural network. The network compares the new picture to all the features it has learned. If the features match what it learned about one of Bu and Bo's friends, it can identify who the friend is.

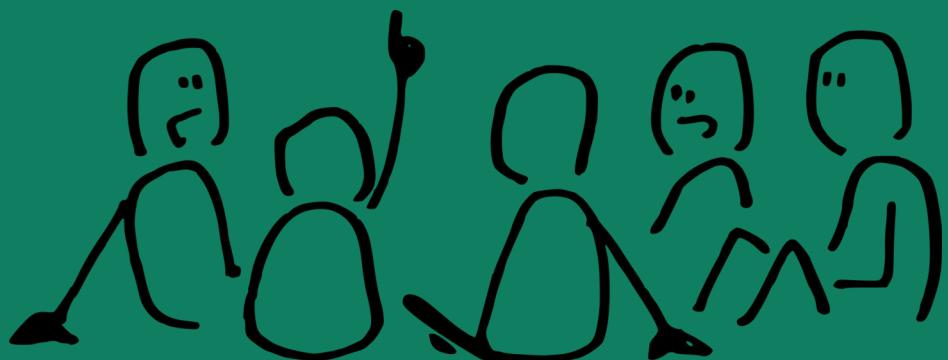
"It's like my brain has learned to see the way you see, and now I can help you find your friends in pictures! Isn't that amazing? Neural networks allow me to see and recognize things just like you do, but in a special, computer way!"



Applications  
of Machine  
Learning



# DISCUSSION TIME



Okay kids! We are almost at the end of our journey. So before we say our goodbyes, can you now list some ways we use machine learning in real life? Take a few minutes and try to name a few.





Machine learning algorithms can identify objects, people, and scenes in images. This is used in facial recognition, medical image analysis, and photo tagging on social media.



By analyzing user preferences and behavior, Machine Learning can help suggest products, movies, or songs. This is seen in services like Netflix, Amazon, and Spotify.



Machine Learning helps cars understand and navigate their environment. This involves object detection, lane recognition, and decision-making processes for safe driving.



Machine Learning-powered chatbots can understand and respond to customer inquiries, providing support and improving user experience on websites and apps.



We've finally reached the end of our amazing adventure, and what a journey it has been! Along the way, we've learned so much about machine learning and its incredible applications. I hope you had as much fun as I did, discovering the fascinating world of technology. As our time together wraps up, it's hard to say goodbye. We've shared so many great moments, and I'll miss our time exploring together. But remember, you can always revisit our adventures and learn more whenever you want. The exciting world of machine learning will always be here for you!

Goodbye for now, my dear friends Bu, Bo, Eddie, and Robo. Until our next adventure, keep being curious and keep learning!

