



PIF
الاستثمار العام
Public Investment Fund

أكاديمية كاوت
KAUST ACADEMY



جامعة الملك عبد الله
للتكنولوجيا
King Abdullah University of
Science and Technology

LEVEL 1: Artificial Intelligence Literacy

Day 1

COURSE OUTLINE

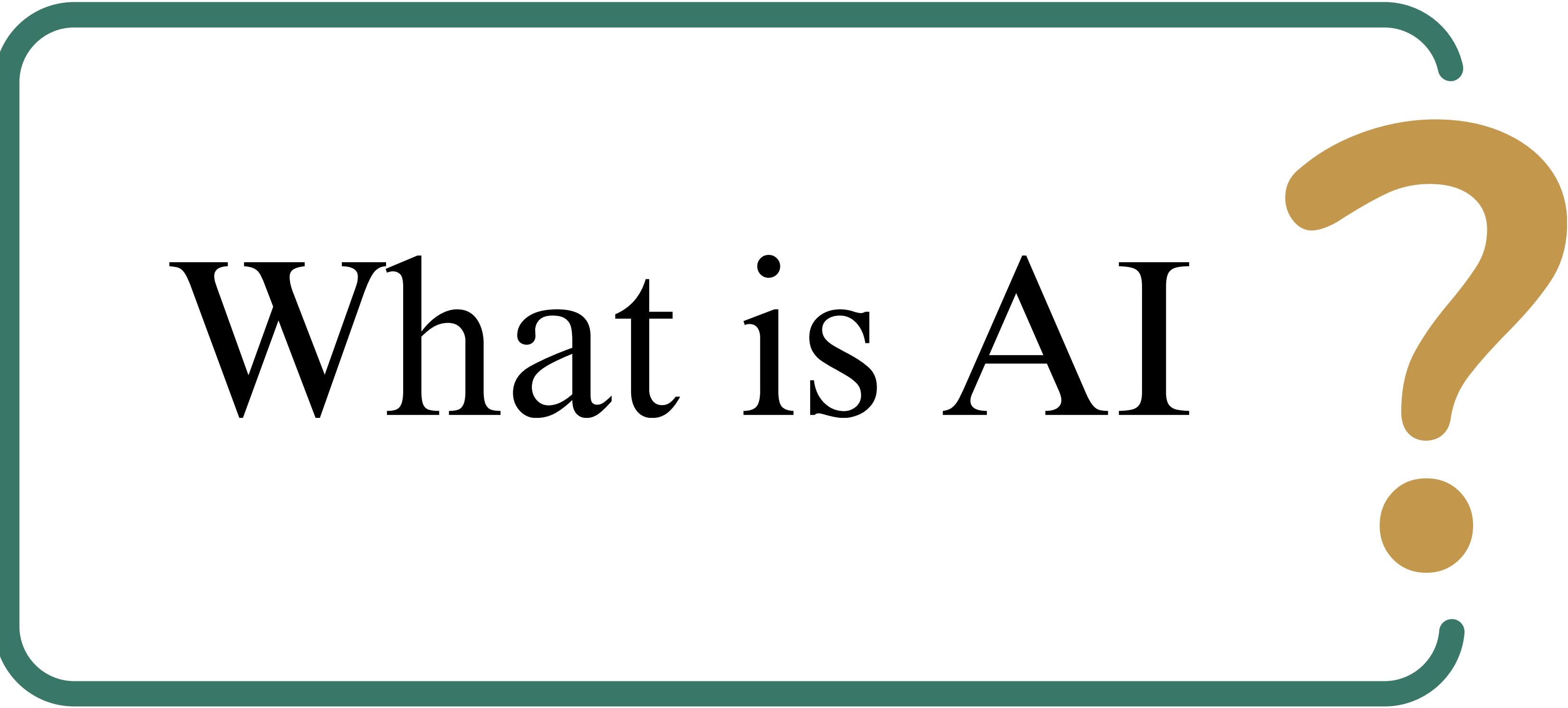
- Introduction to Artificial Intelligence
- History of Artificial Intelligence
- Applications of Artificial Intelligence
- Prompting and Interaction with LLMs
- Regression Example: Predicting Home Prices
- Classification Example: Predicting Buyer Segments
- Unsupervised Learning Example: Understanding Energy Usage

Learning Objectives

- Recognize what Artificial Intelligence is and how it fits into modern technology.
- Understand the development and evolution of AI throughout history.
- Explore real-world applications of AI across various industries.
- Learn the concept of Machine Learning and how machines learn from data.
- Apply regression techniques to predict numerical values.
- Apply classification methods to categorize data into groups.
- Discover hidden patterns in data without labels using unsupervised learning.

Artificial Intelligence

Introduction



What is AI?

Artificial Intelligence (AI)

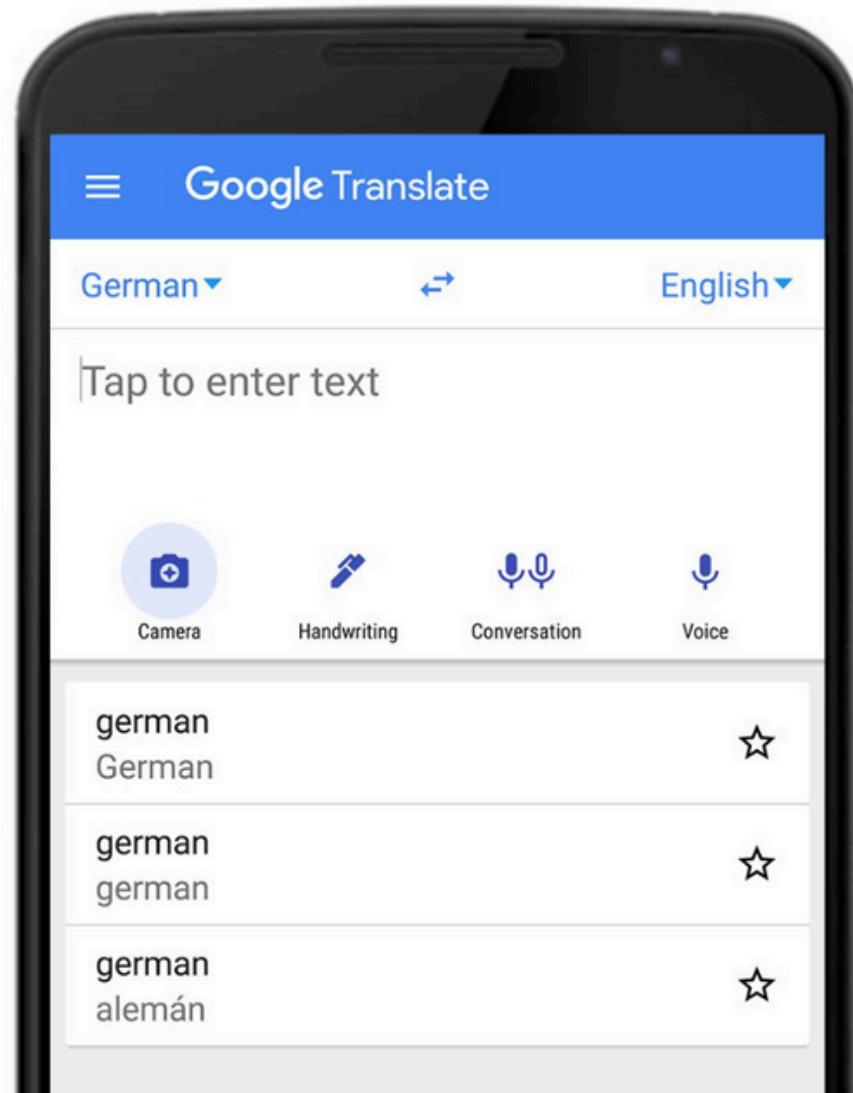
- Artificial Intelligence (AI) is a set of technologies that allows computers to learn, reason, and perform advanced tasks that once required human intelligence.



Artificial Intelligence (AI)

- AI enables machines to understand and generate human language

»» Real-time translation



Artificial Intelligence (AI)

- AI enables machines to understand and generate human language

» Customer support chatbots
& voice assistants



Artificial Intelligence (AI)

- AI enables machines to understand and generate human language

»» Sentiment analysis for business & social media



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Artificial Intelligence (AI)

- AI gives machines the ability to see and understand images, sometimes outperforming human vision.

» Plate recognition



Artificial Intelligence (AI)

- AI gives machines the ability to see and understand images, sometimes outperforming human vision.

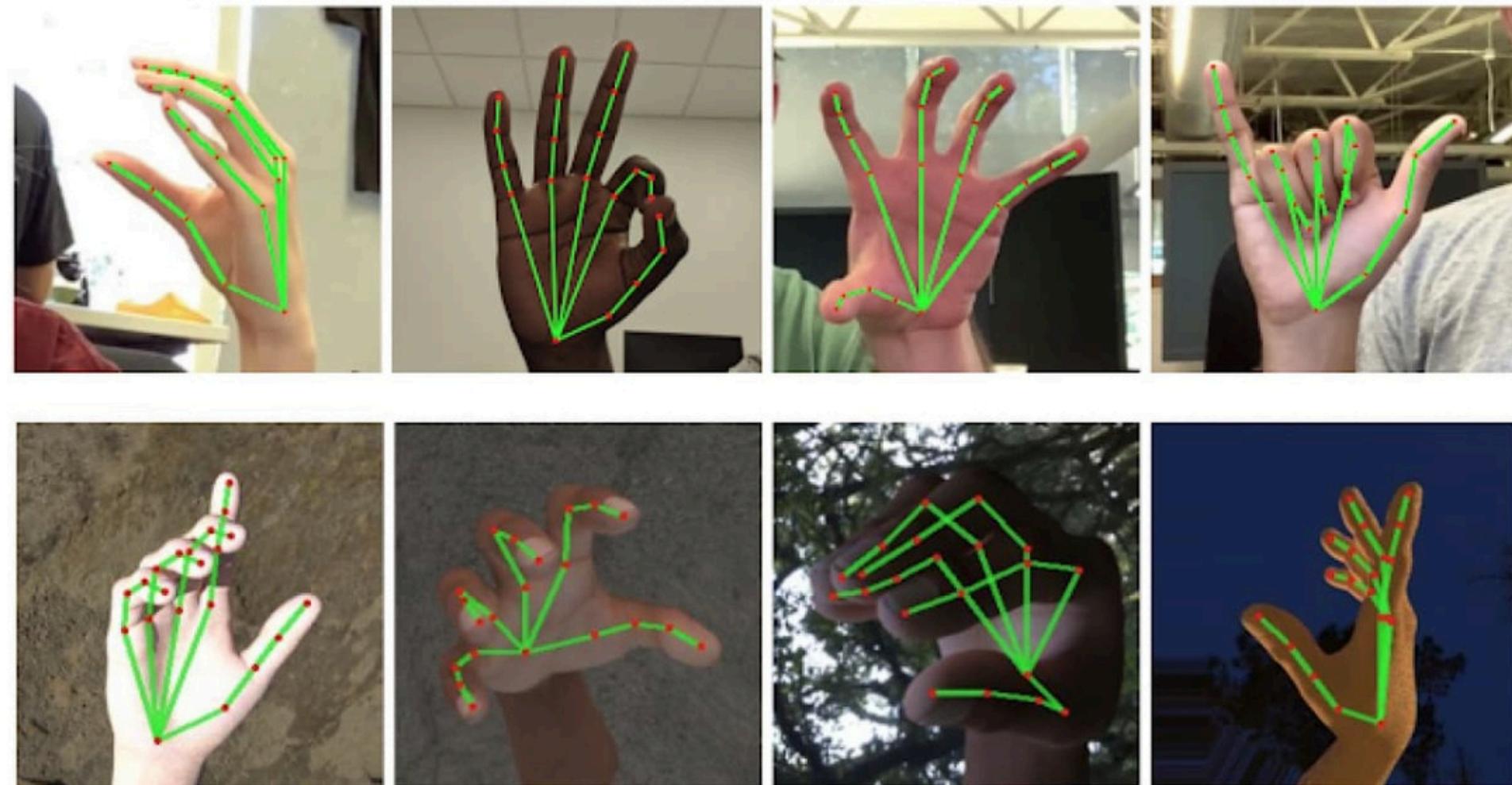
» Face recognition



Artificial Intelligence (AI)

- AI gives machines the ability to see and understand images, sometimes outperforming human vision.

»» Gesture recognition



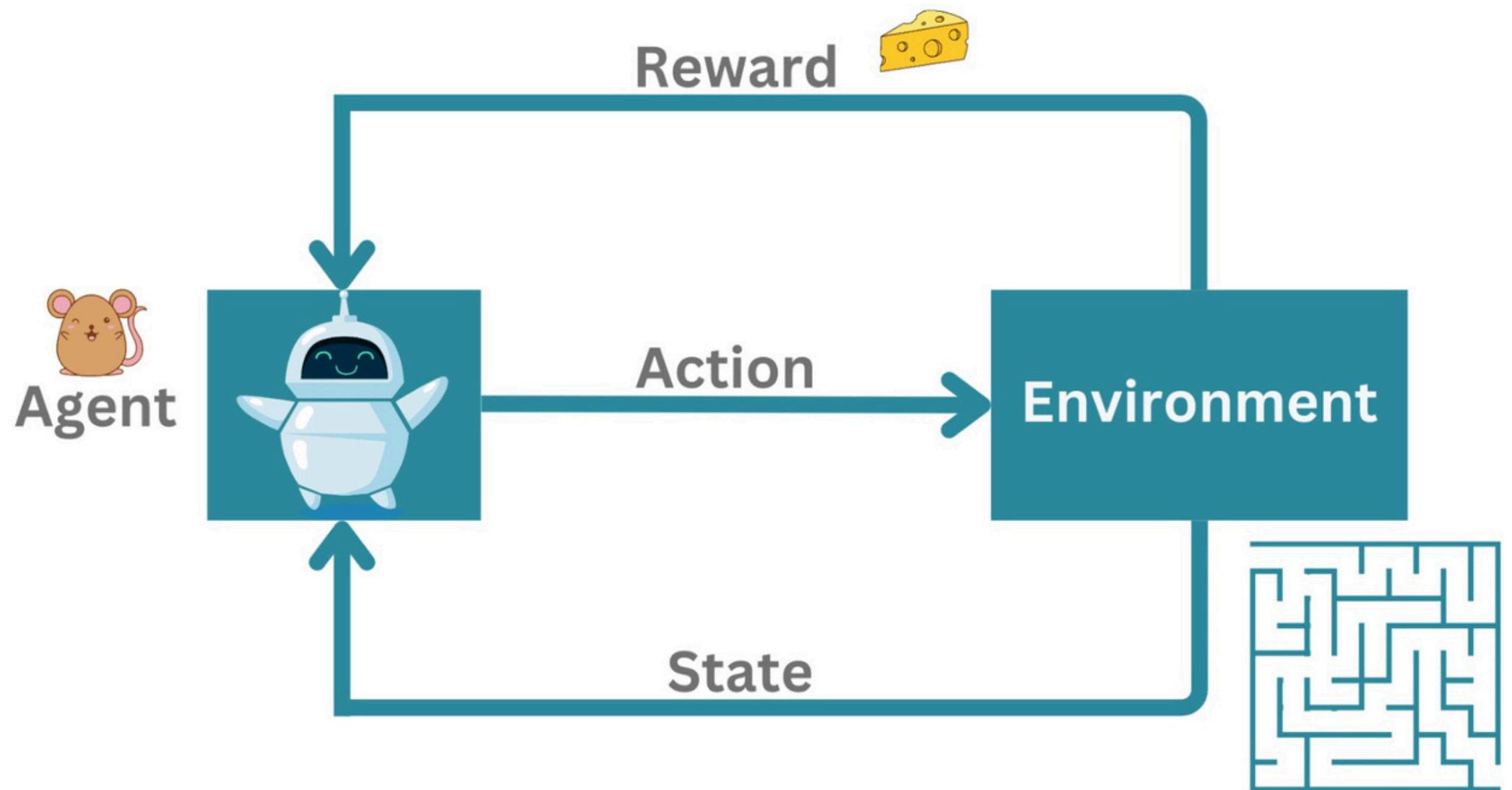
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Artificial Intelligence (AI)

- AI trains robots to learn how to walk by trying, making mistakes, and getting rewards when they do it right.

»» Robot in a Maze

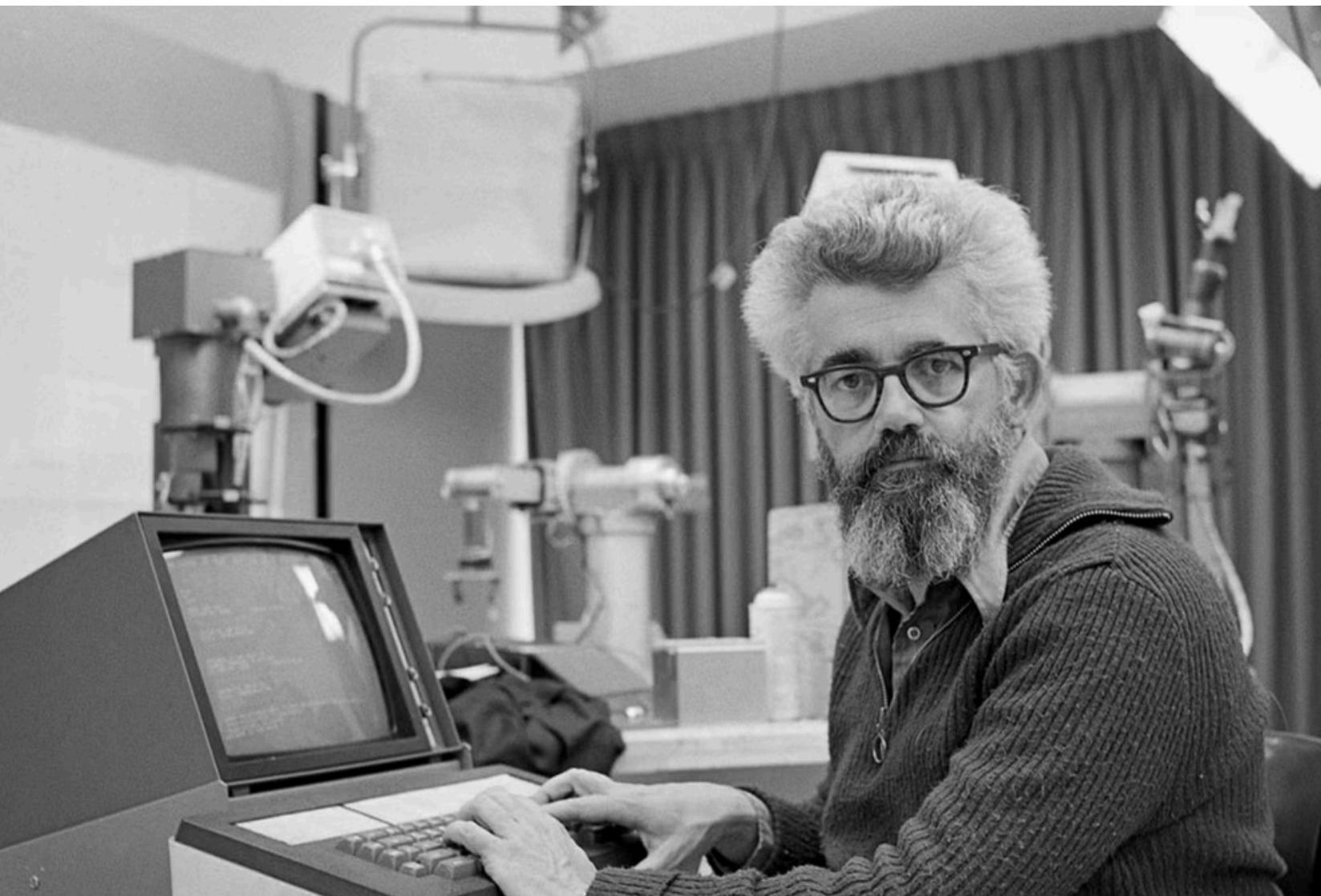


Artificial Intelligence

History

History of Artificial Intelligence

»» 1956: AI was established as a formal field during the Dartmouth Conference.



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History of Artificial Intelligence

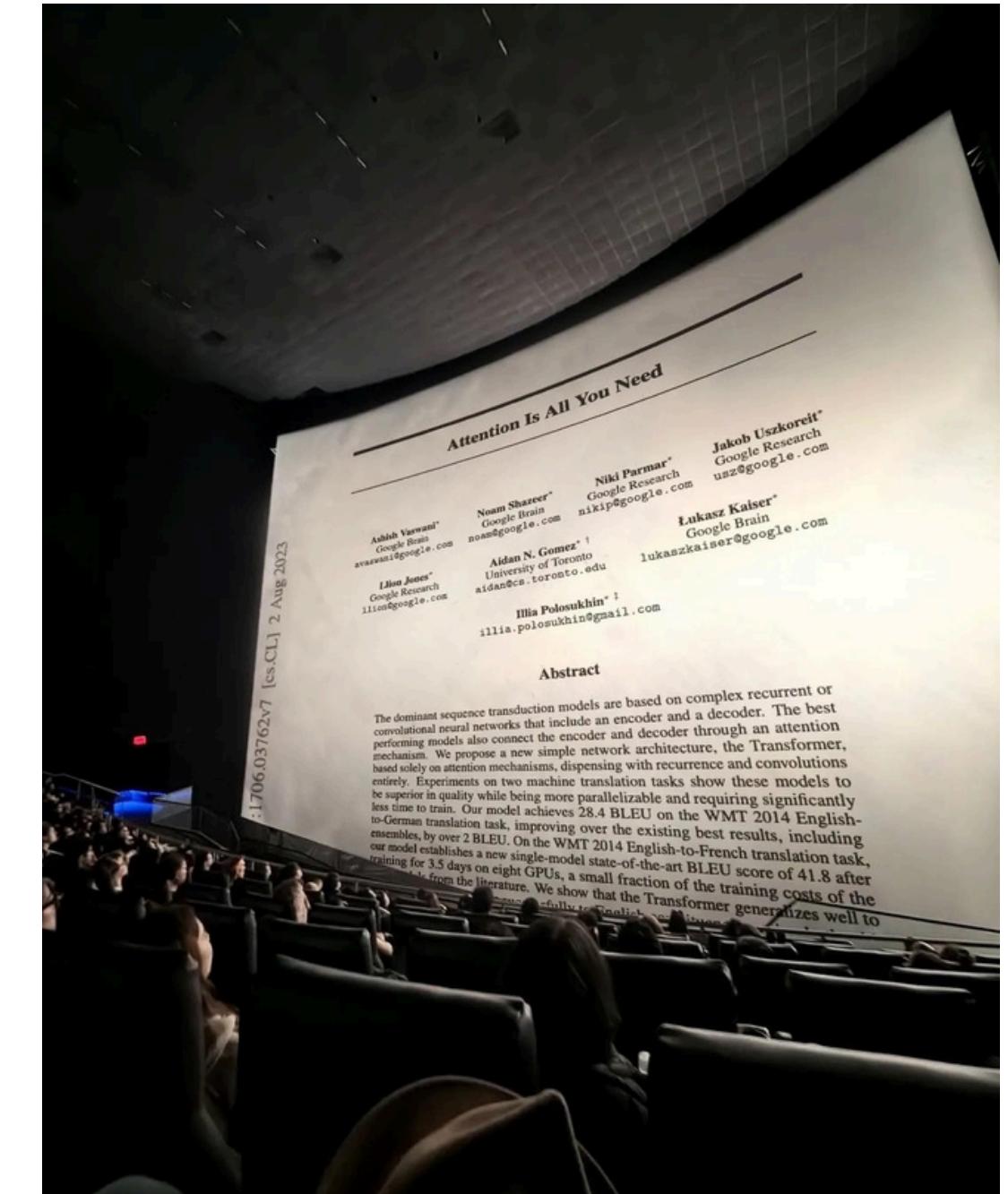
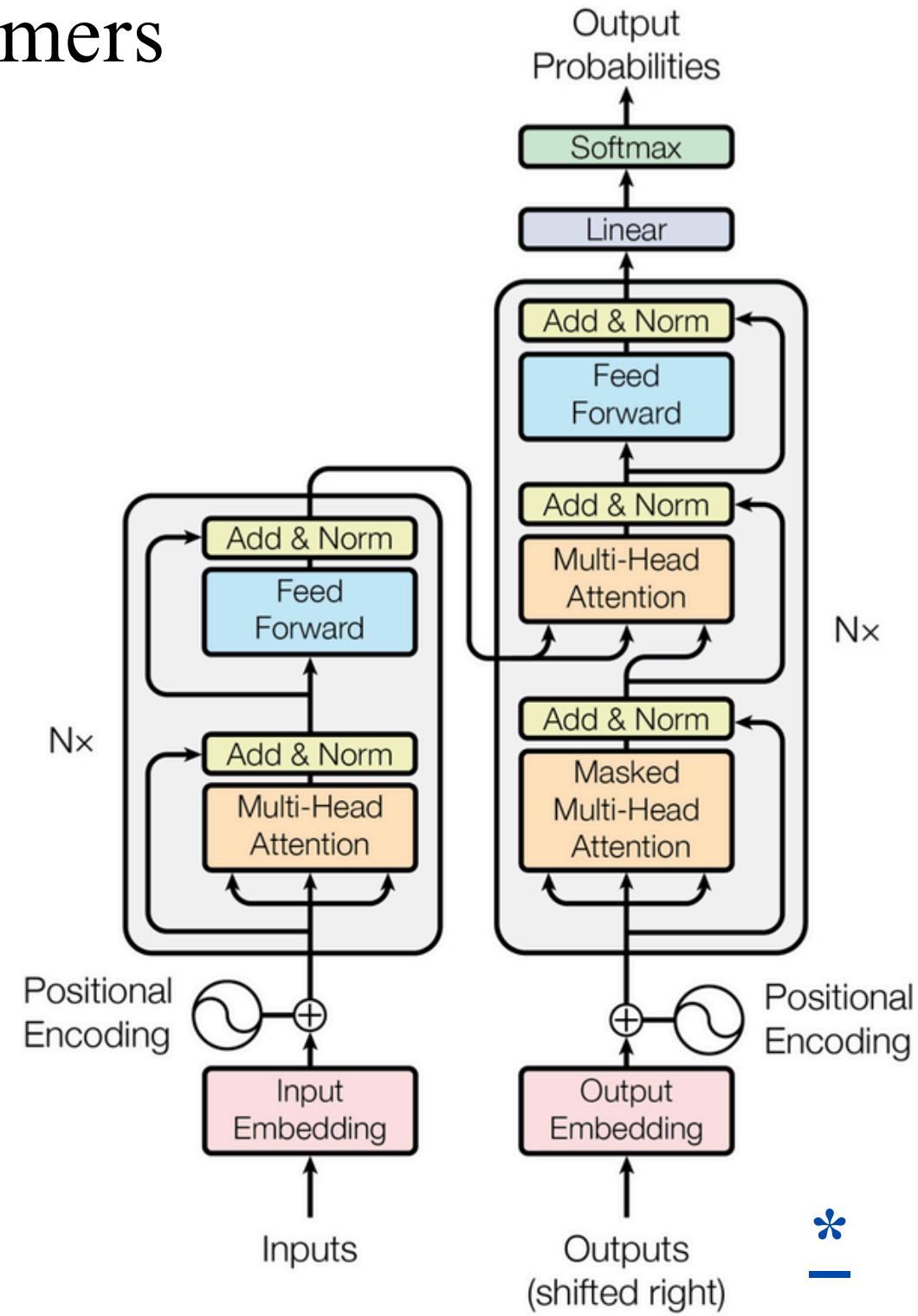
»» 1997 : IBM's Deep Blue defeats the world chess champion.



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History of Artificial Intelligence

» 2017: Attention and Transformers



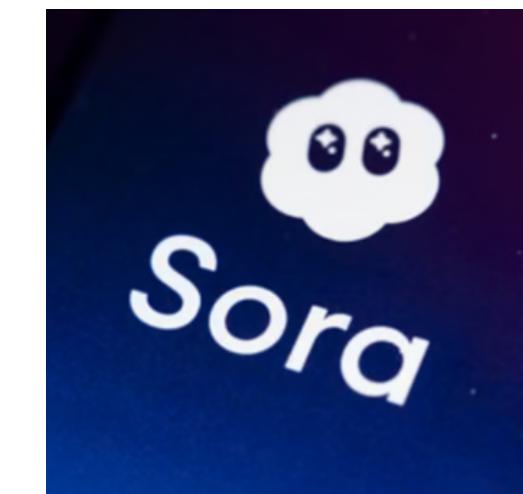
History of Artificial Intelligence

»» 2020 to 2025: LLMs and VLMs



DALL-E

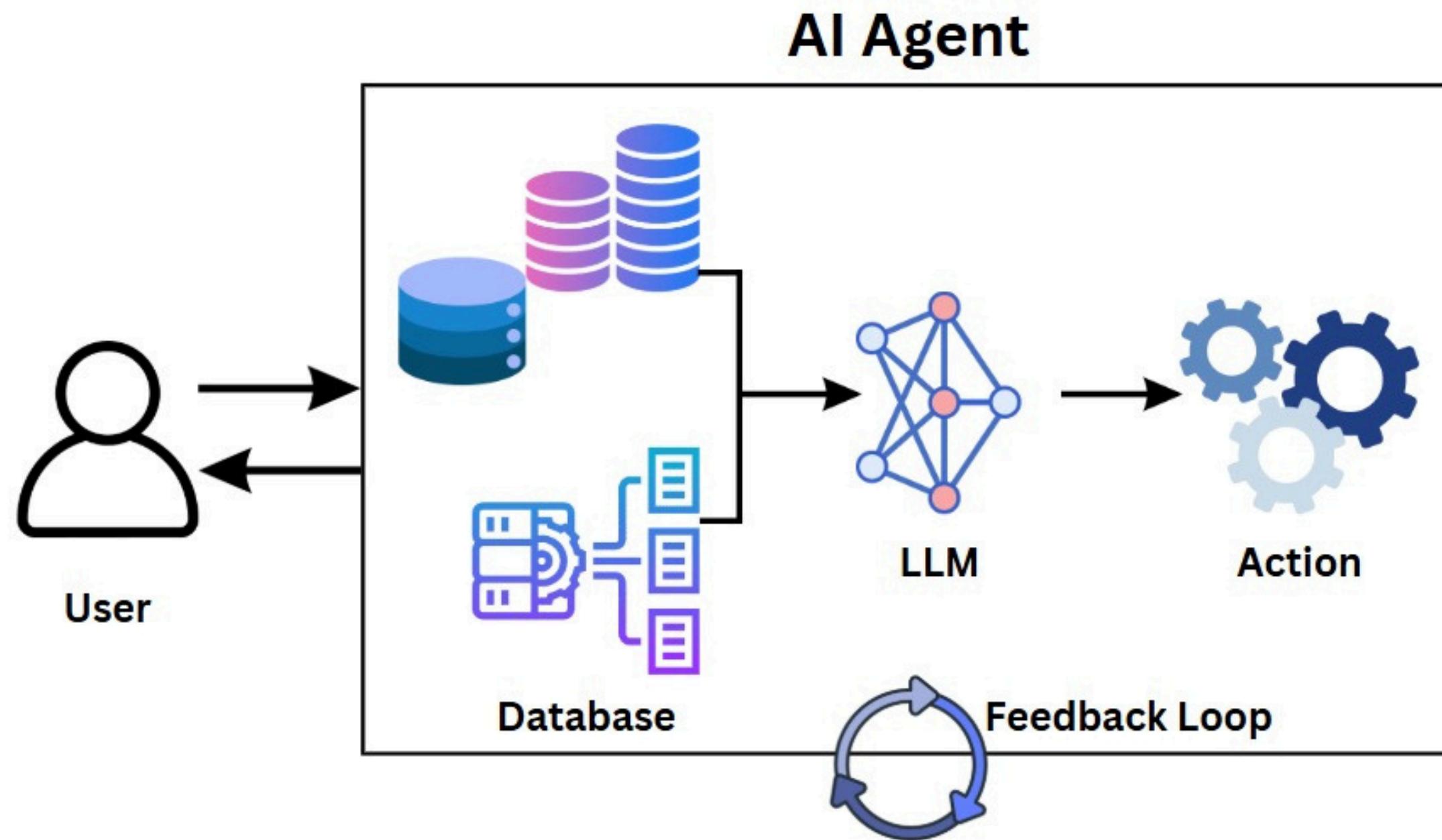
ALLAM
Arabic Large Language Model



Gemini

History of Artificial Intelligence

» 2025+: Agentic AI





What's next for AI?

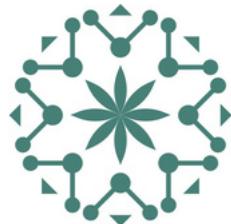
Artificial Intelligence

Machine Learning

How does the machine
learn to do all of this



ROSHN, a mega-project by PIF building integrated, sustainable communities across Saudi Arabia.



مجموعة روشن
ROSHN GROUP



ROSHN, a mega-project by PIF building integrated, sustainable communities across Saudi Arabia.



مجموعة روشن
ROSHN GROUP



Machine Learning

» Problem 1:

ROSHN needs an accurate method to estimate home prices in advance.

Machine Learning

» Problem 1:

ROSHN needs an accurate method to estimate home prices in advance.

Why?

Machine Learning

» Problem 1:

ROSHN needs an accurate method to estimate home prices in advance.

Why?

- Too high = fewer sales

Machine Learning

» Problem 1:

ROSHN needs an accurate method to estimate home prices in advance.

Why?

- Too high = fewer sales,
- Too low = less revenue.

Machine Learning

» Problem 1:

ROSHN needs an accurate method to estimate home prices in advance.

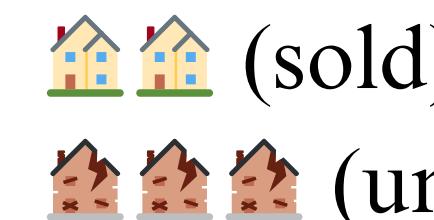
Why?

- Too high = fewer sales,
- Too low = less revenue.

Expected sales:



Reality:



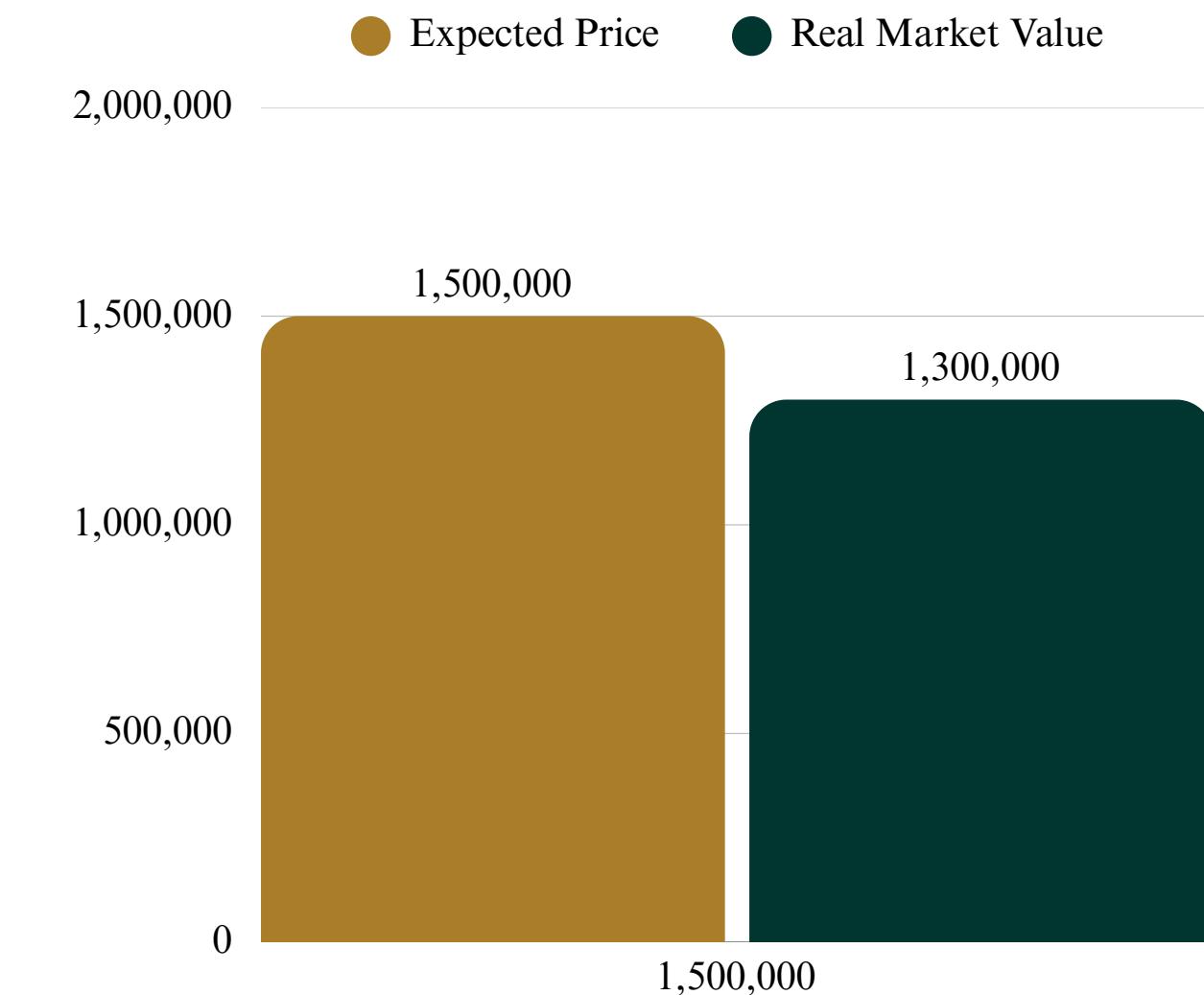
Machine Learning

» Problem 1:

ROSHN needs an accurate method to estimate home prices in advance.

Why?

- Too high = fewer sales,
- Too low = less revenue.



Machine Learning

Luckily, we have historical data from previous similar projects.

Machine Learning

ID	Size (m ²)	Rooms	Type	Parking	View	Distance to Masjed(km)	Year Built	Price (SAR)
1	120	3	Apartment	1	Street	1.2	2021	950,000
2	180	4	Villa	2	Park	0.8	2022	1,350,000
3	140	3	Apartment	1	City	2	2020	980,000
4	220	5	Villa	3	Garden	0.5	2023	1,850,000
5	160	4	Townhouse	2	Street	1.5	2021	1,200,000
6	200	5	Villa	2	Park	1	2024	1,700,000
7	95	2	Apartment	1	Street	1.8	2019	720,000
8	250	6	Villa	3	Lake	0.3	2023	2,300,000
9	130	3	Apartment	1	Garden	1.1	2022	1,020,000
10	175	4	Townhouse	2	Park	0.7	2023	1,450,000

Machine Learning

Features , Inputs, Predictors, Attributes



ID	Size (m ²)	Rooms	Type	Parking	View	Distance to Masjed(km)	Year Built	Price (SAR)
1	120	3	Apartment	1	Street	1.2	2021	950,000
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Machine Learning

Label, Target, Output, Ground truth



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Machine Learning

»» Let's take one feature

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Machine Learning

»» We want to predict the price of a new property.

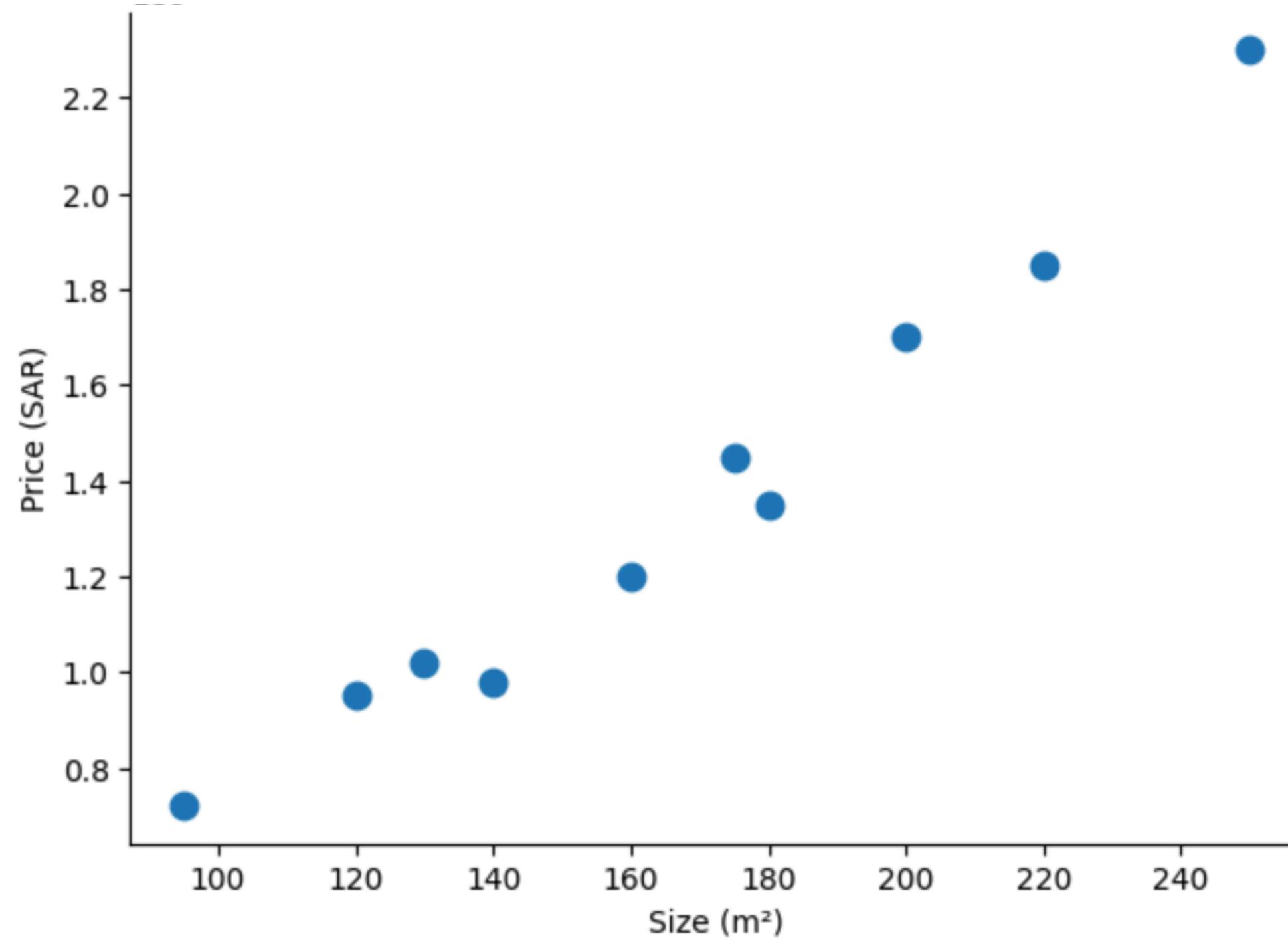
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Machine Learning

Size (m ²)
120
180
140
220
160
200
95
250
130
175

Price (SAR)
950,000
1,350,000
980,000
1,850,000
1,200,000
1,700,000
720,000
2,300,000
1,020,000
1,450,000

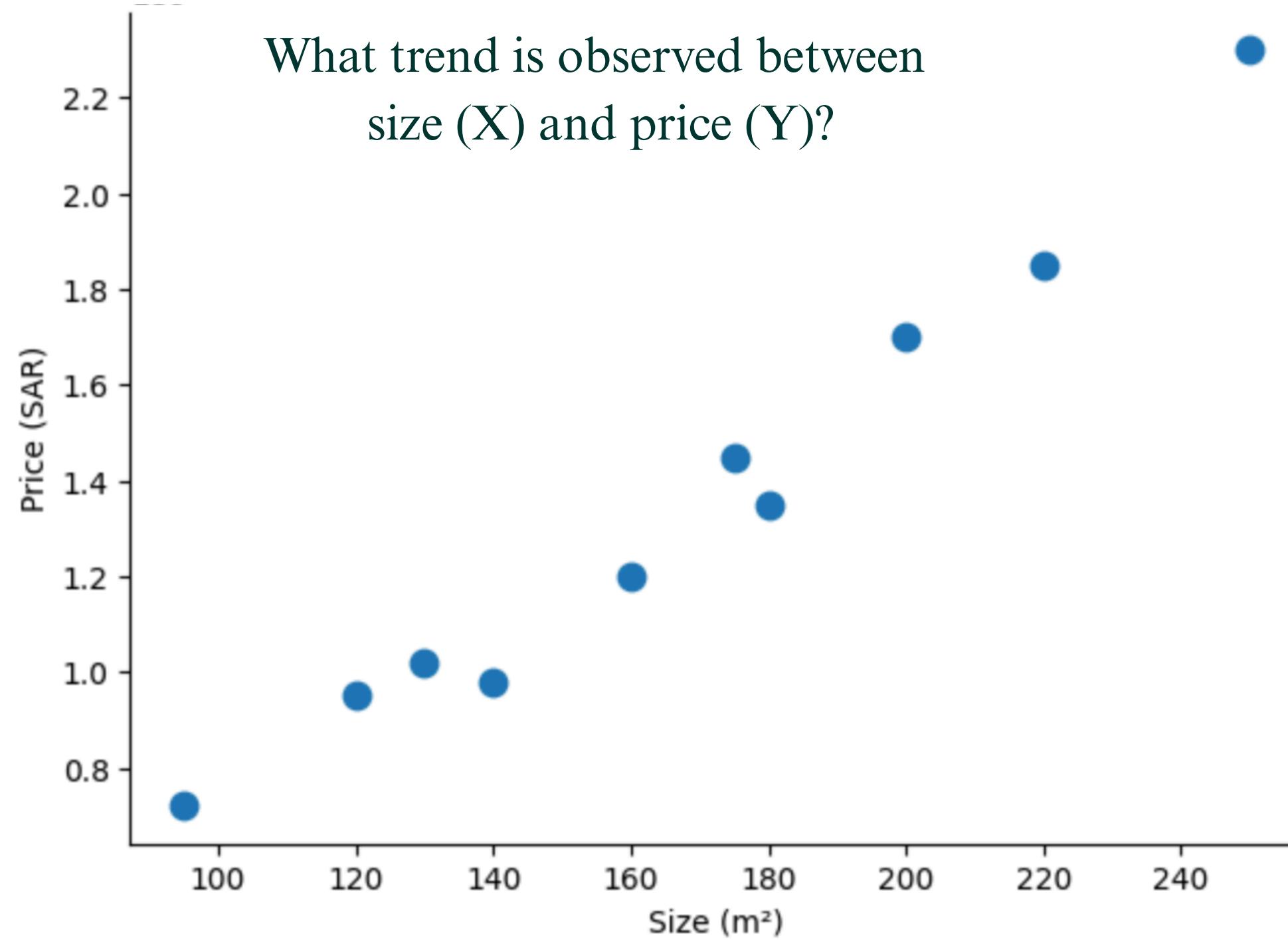


Machine Learning

Size (m ²)
120
180
140
220
160
200
95
250
130
175

Price (SAR)
950,000
1,350,000
980,000
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720,000
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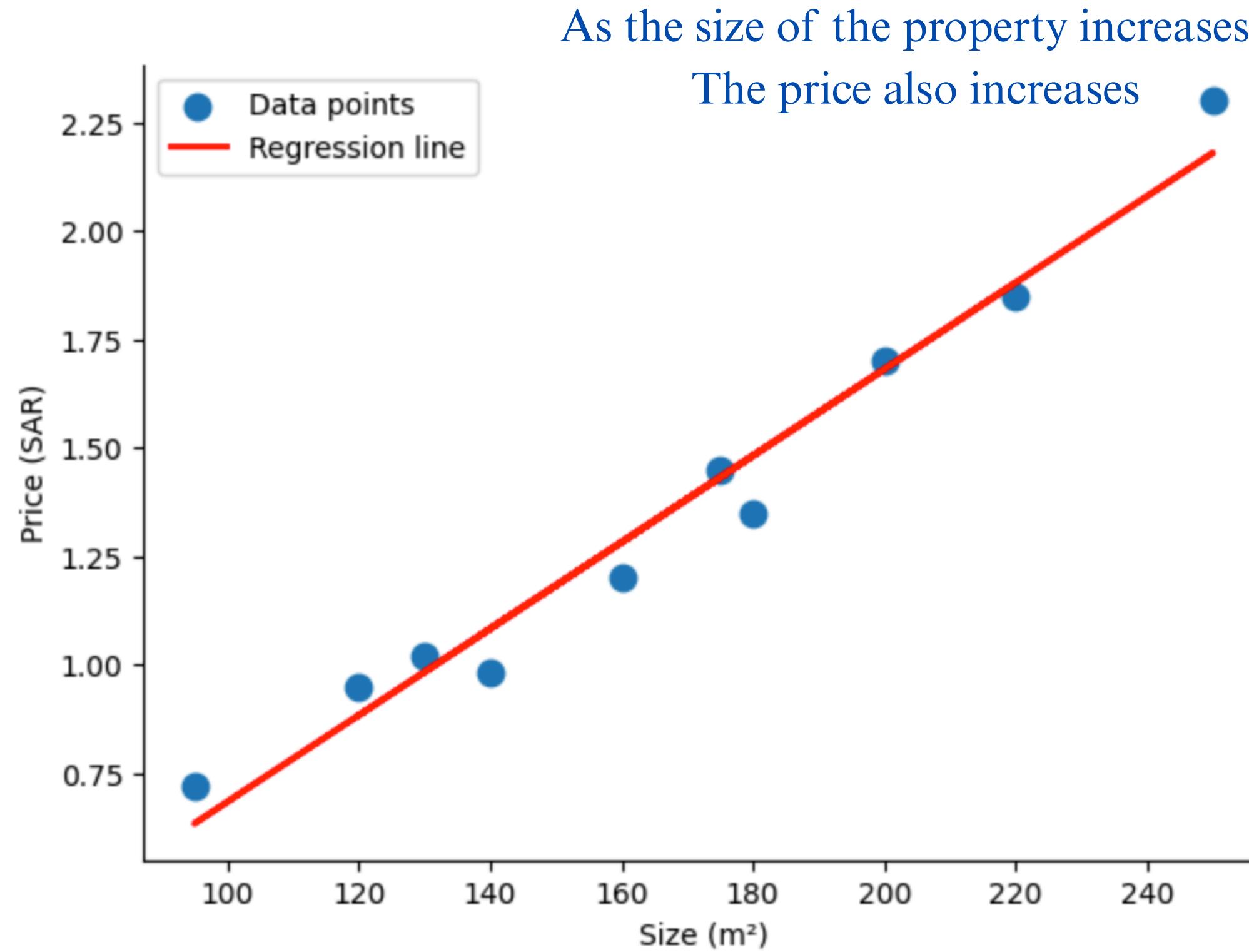
What trend is observed between size (X) and price (Y)?



Machine Learning

Size (m ²)
120
180
140
220
160
200
95
250
130
175

Price (SAR)
950,000
1,350,000
980,000
1,850,000
1,200,000
1,700,000
720,000
2,300,000
1,020,000
1,450,000



Machine Learning

»» Old programming takes input and rules to generate output.



Machine Learning

»» Old programming takes input and rules to generate output.



»» Machine Learning takes input and output examples to **learn** the rules

Machine Learning

Machine Learning is a branch of Artificial Intelligence that enables computers to learn patterns from data and make predictions or decisions without being explicitly programmed.

Artificial Intelligence

Machine
Learning

Deep
Learning

Machine Learning

» Problem 2:

ROSHN wants to know which customer segment to target for each unit.

Machine Learning

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ROSHN wants to know which customer segment to target for each unit.

Why?

Machine Learning

» Problem 2:

ROSHN wants to know which customer segment to target for each unit.

Why?

- To match each unit with the right buyer group.

Machine Learning

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ROSHN wants to know which customer segment to target for each unit.

Why?

- To match each unit with the right buyer group.
- Avoid offering budget homes to high-income buyers.



Machine Learning

» Problem 2:

ROSHN wants to know which customer segment to target for each unit.

Why?

- To match each unit with the right buyer group.
- Avoid offering budget homes to high-income buyers.
- Avoid offering expensive homes to budget buyers.



Machine Learning

ID	Size (m ²)	Rooms	Type	Parking	View	Distance to Masjed(km)	Year Built	Price (SAR)	Customer Segment
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Machine Learning

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Label
↓

Customer Segment
Economy
Mid
Economy
Luxury
Mid
Luxury
Economy
Luxury
Mid
Mid

Machine Learning

What's different about the label?

Label
↓

ID	Size (m ²)	Rooms	Type	Parking	View	Distance to Masjed(km)	Year Built	Price (SAR)
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Customer Segment
Economy
Mid
Economy
Luxury
Mid
Luxury
Economy
Luxury
Mid
Mid

Machine Learning

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Label
↓

Customer Segment
Economy
Mid
Economy
Luxury
Mid
Luxury
Economy
Luxury
Mid
Mid

Machine Learning

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10	175	4	Townhouse	2	Park	0.7	2023	1,450,000

Label
↓

Customer Segment
Economy
Mid
Economy
Luxury
Mid
Luxury
Economy
Luxury
Mid
Mid

Machine Learning

It's categorical now, not numerical.

Label
↓

ID	Size (m ²)	Rooms	Type	Parking	View	Distance to Masjed(km)	Year Built	Price (SAR)	Customer Segment
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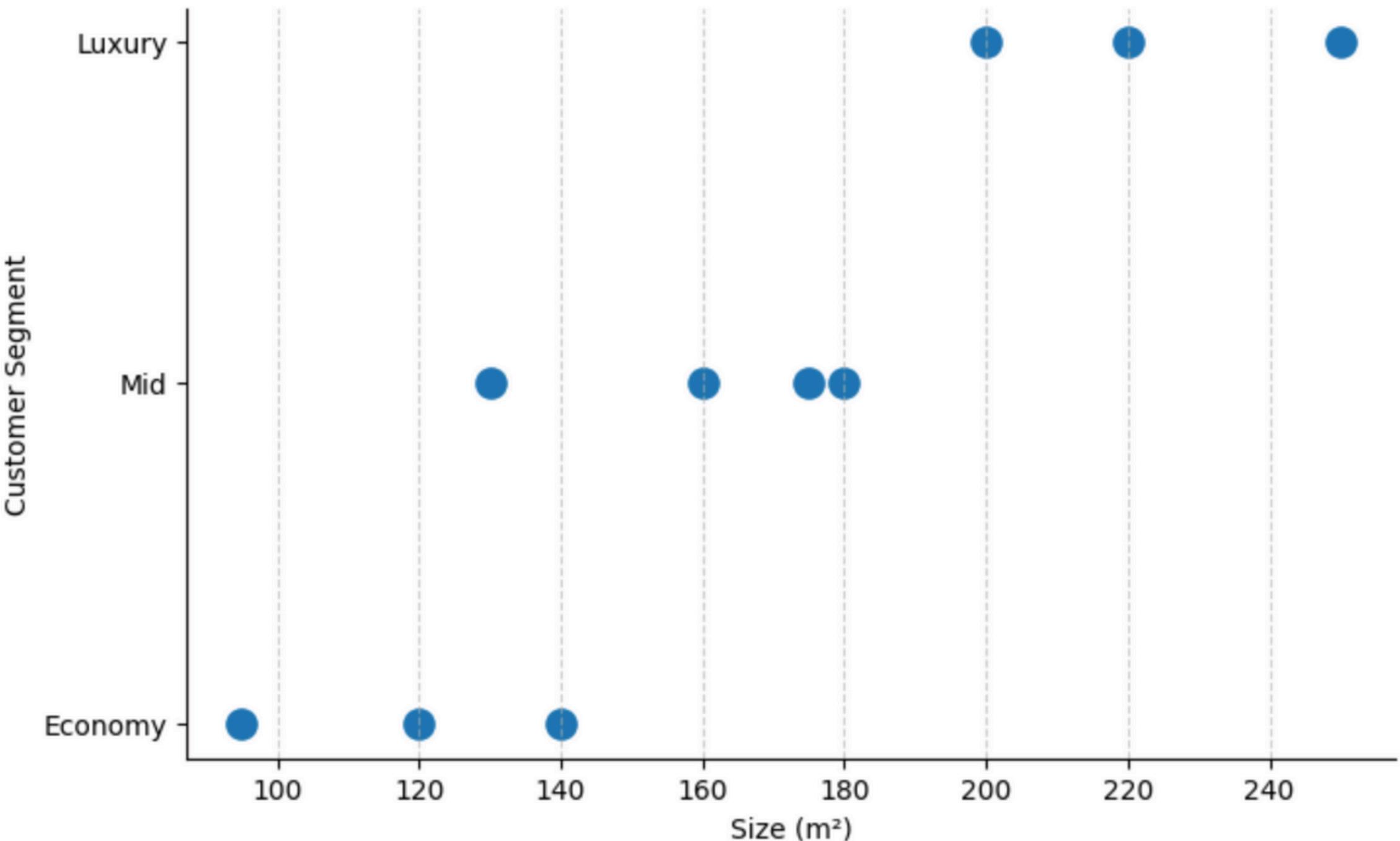
Machine Learning

Size (m ²)	Customer Segment
120	Economy
180	Mid
140	Economy
220	Luxury
160	Mid
200	Luxury
95	Economy
250	Luxury
130	Mid
175	Mid

Machine Learning

Size (m ²)	Customer Segment
120	Economy
180	Mid
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160	Mid
200	Luxury
95	Economy
250	Luxury
130	Mid
175	Mid

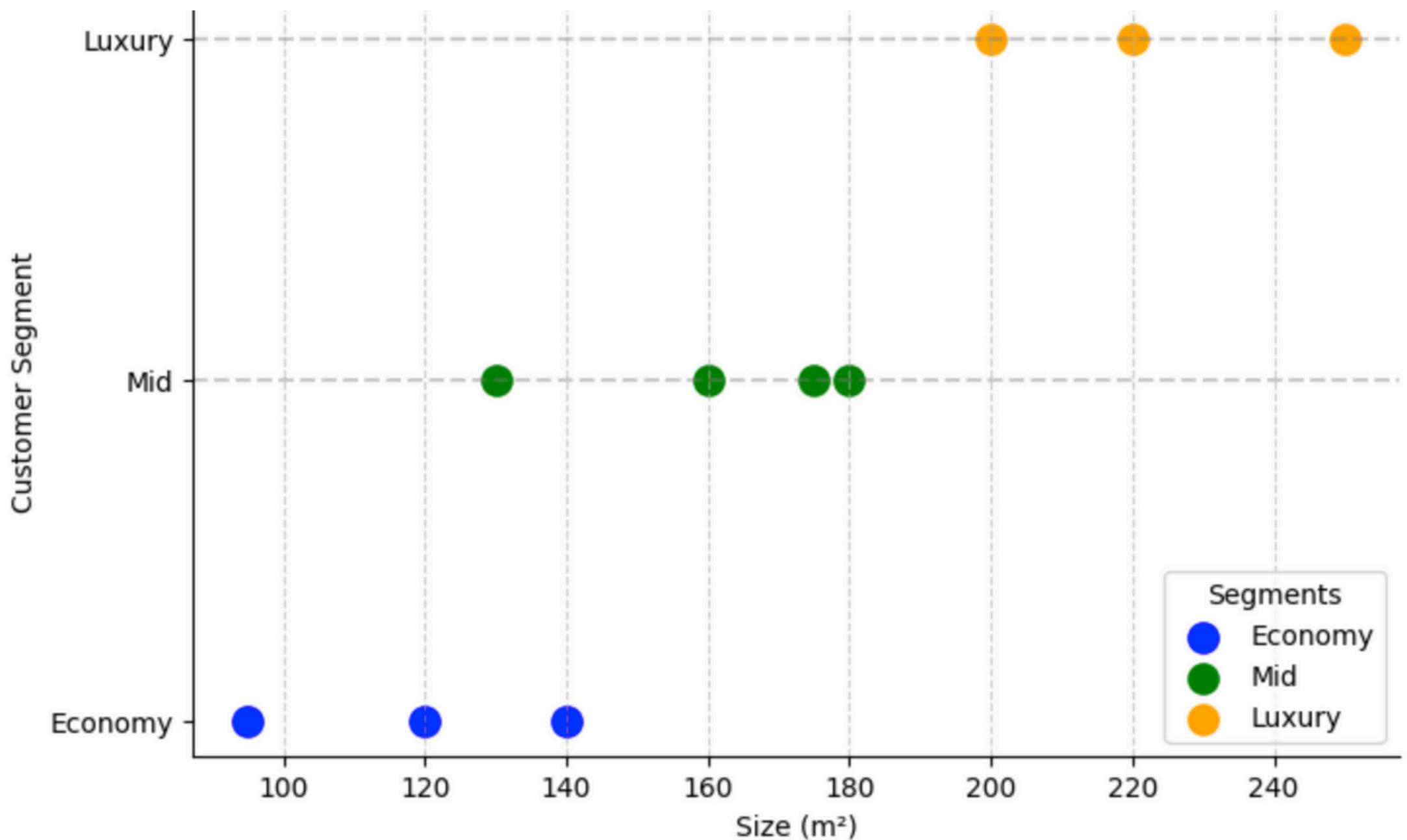
What does size tell us about the segment?



Machine Learning

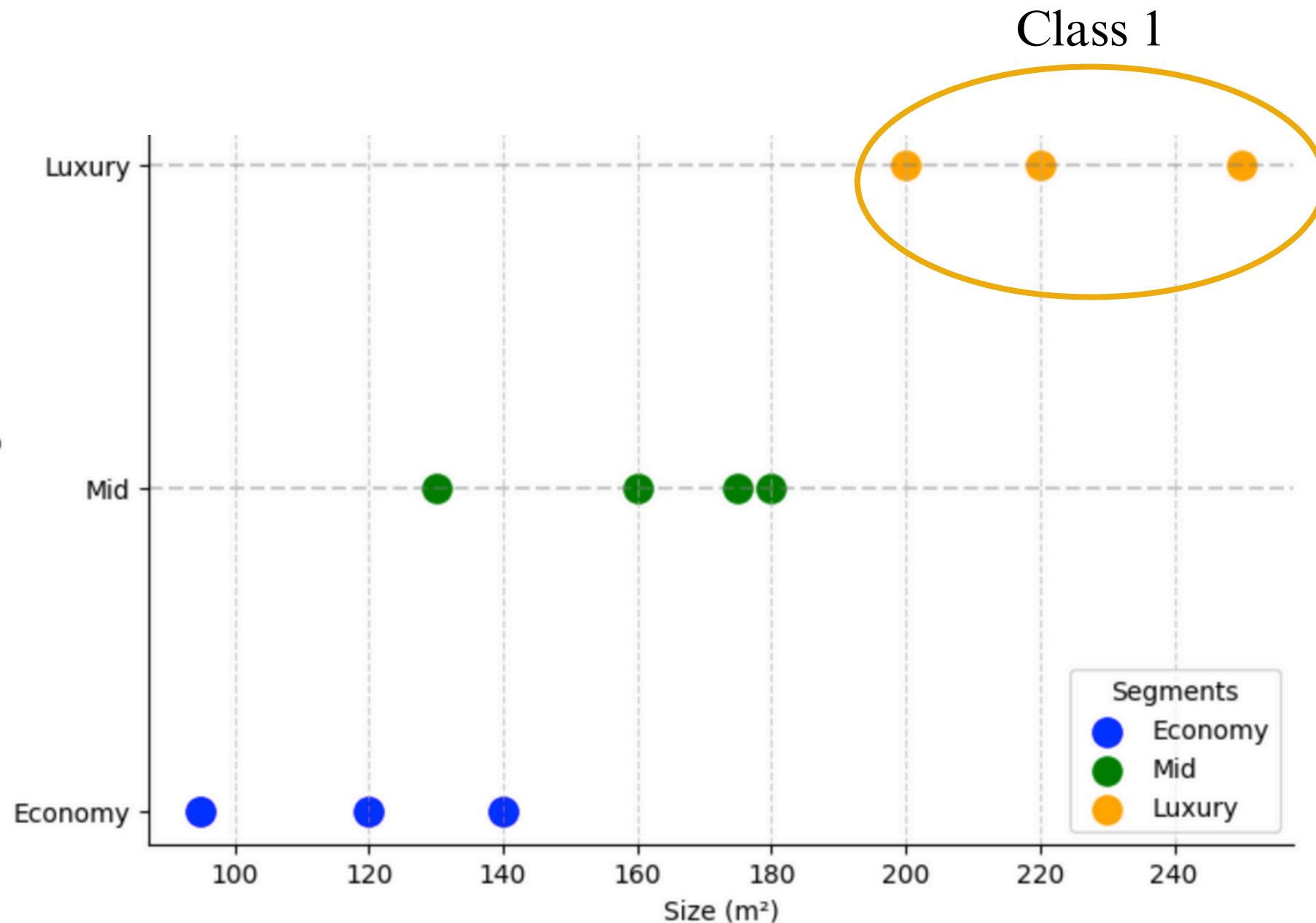
Size (m ²)
120
180
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220
160
200
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250
130
175

Customer Segment
Economy
Mid
Economy
Luxury
Mid
Luxury
Economy
Luxury
Mid
Mid



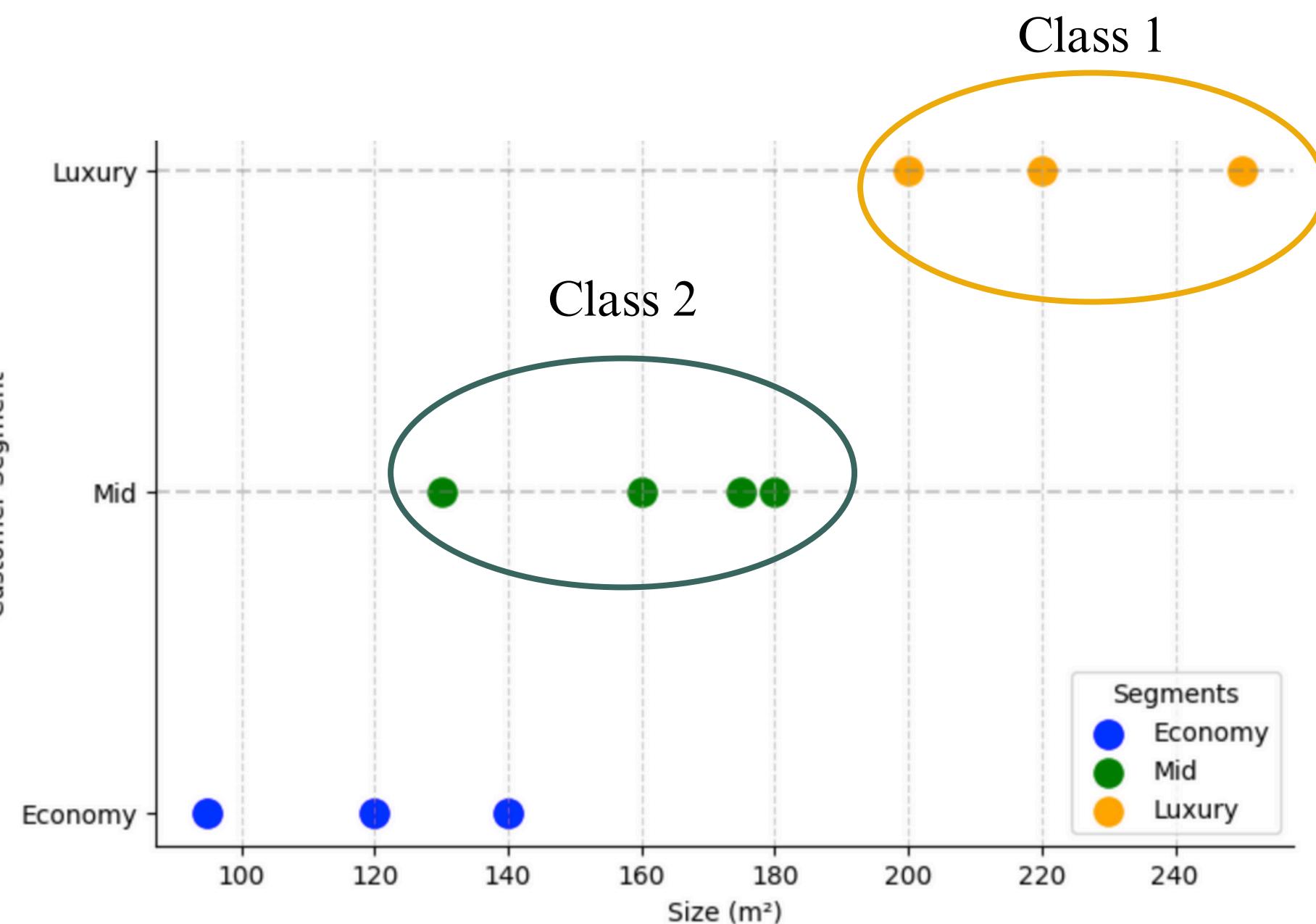
Machine Learning

Size (m ²)	Customer Segment
120	Economy
180	Mid
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200	Luxury
95	Economy
250	Luxury
130	Mid
175	Mid



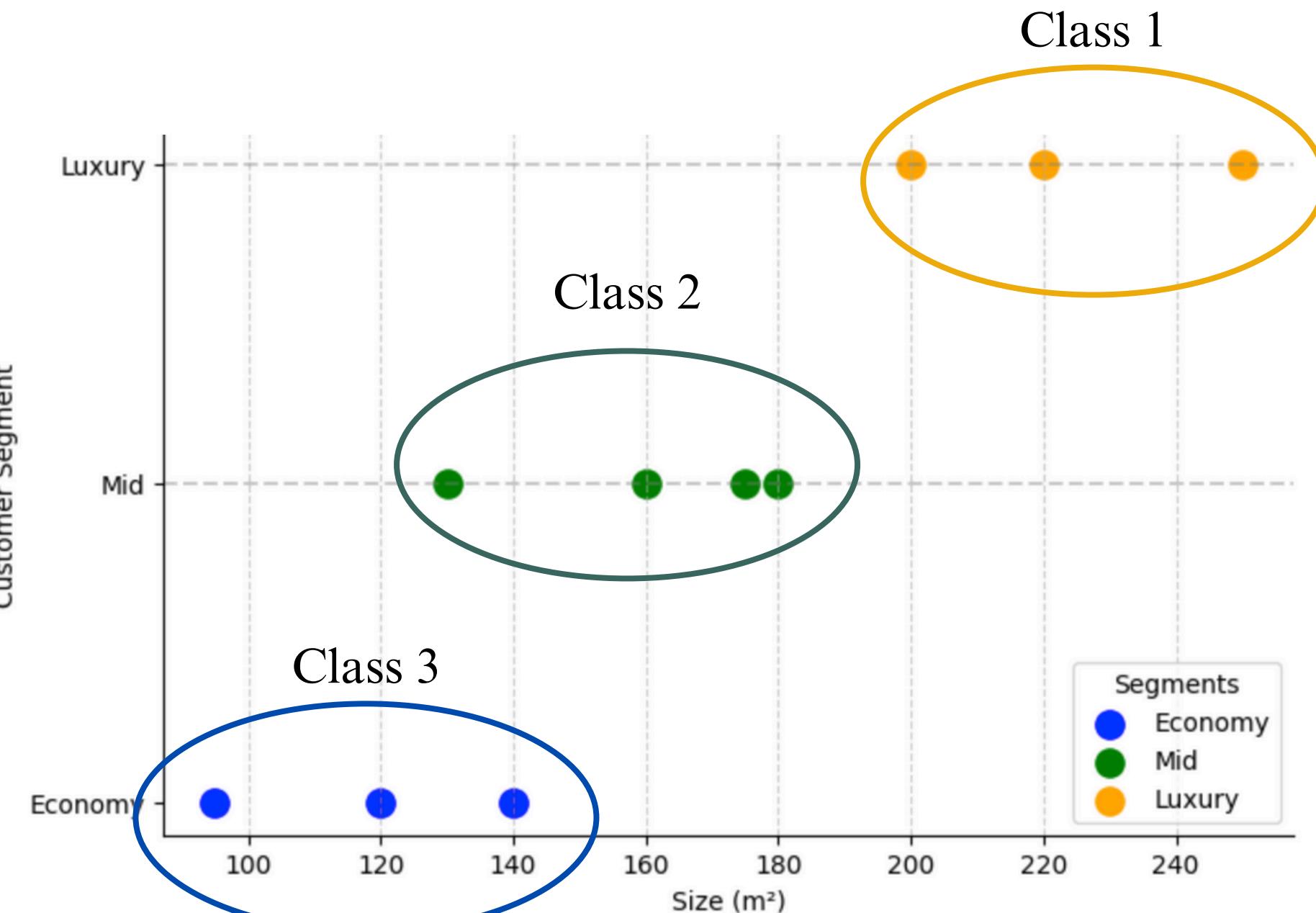
Machine Learning

Size (m ²)	Customer Segment
120	Economy
180	Mid
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220	Luxury
160	Mid
200	Luxury
95	Economy
250	Luxury
130	Mid
175	Mid



Machine Learning

Size (m ²)	Customer Segment
120	Economy
180	Mid
140	Economy
220	Luxury
160	Mid
200	Luxury
95	Economy
250	Luxury
130	Mid
175	Mid



Machine Learning

»» Problem 1:

Predicting home price



Regression

An ML task where the goal is to predict a continuous numerical value.

Machine Learning

» Problem 1:

Predicting home price



Regression

An ML task where the goal is to predict a continuous numerical value.

» Problem 2:

Classify the customer segment



Classification

An ML task where the goal is to assign each input to a predefined category.

Machine Learning

» Problem 3:

ROSHN wants to minimize the energy consumption of its buildings

Machine Learning

» Problem 3:

ROSHN wants to minimize the energy consumption of its buildings

Why?

Machine Learning

» Problem 3:

ROSHN wants to minimize the energy consumption of its buildings

Why?

- Improve sustainability and meet green targets.

Machine Learning

» Problem 3:

ROSHN wants to minimize the energy consumption of its buildings

Why?

- Improve sustainability and meet green targets.
- Increase building efficiency and performance.

Machine Learning

» Problem 3:

ROSHN wants to minimize the energy consumption of its buildings

Why?

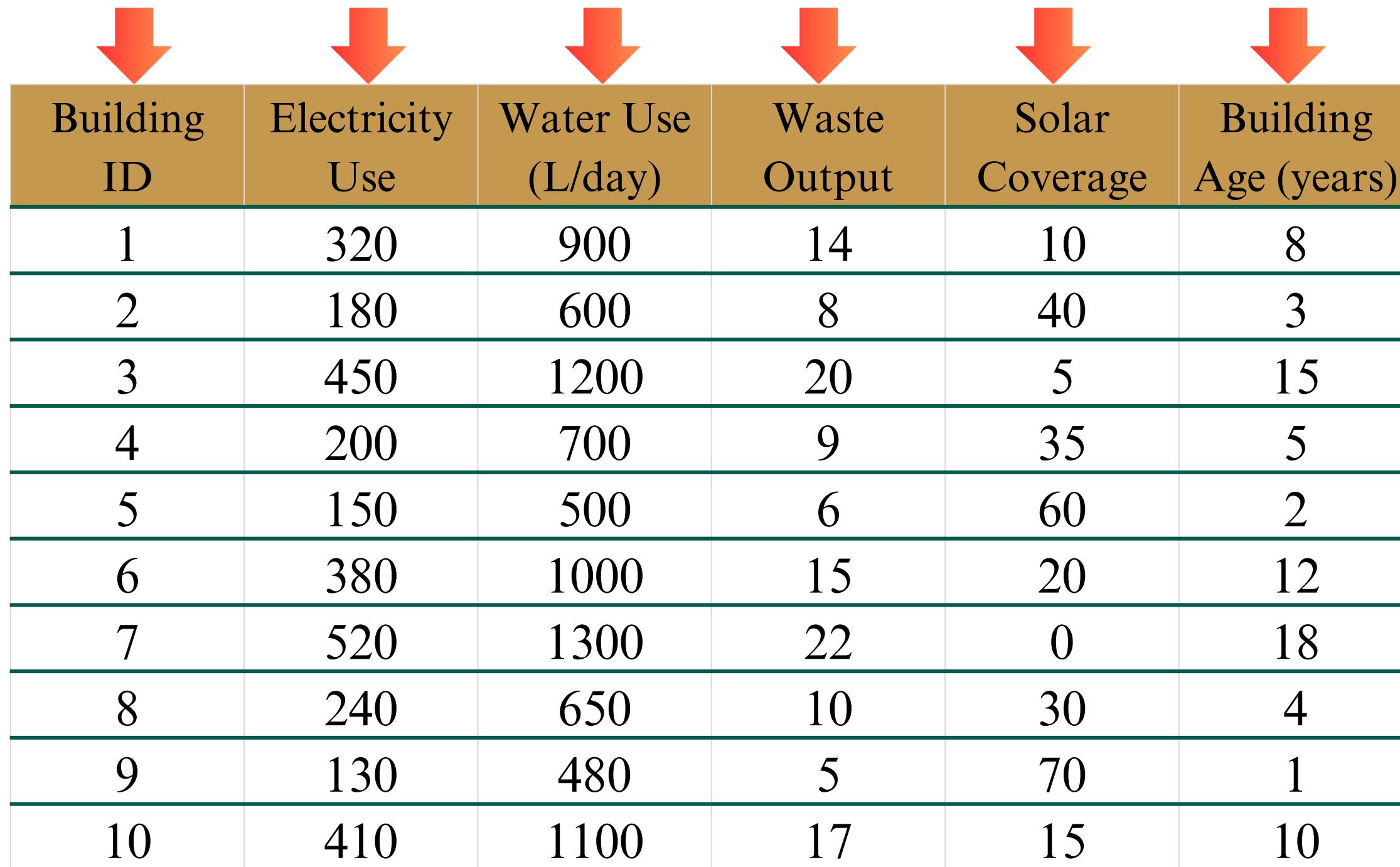
- Improve sustainability and meet green targets.
- Increase building efficiency and performance.
- Reduce long-term maintenance and utility expenses.

Machine Learning

Building ID	Electricity Use	Water Use (L/day)	Waste Output	Solar Coverage	Building Age
1	320	900	14	10	8
2	180	600	8	40	3
3	450	1200	20	5	15
4	200	700	9	35	5
5	150	500	6	60	2
6	380	1000	15	20	12
7	520	1300	22	0	18
8	240	650	10	30	4
9	130	480	5	70	1
10	410	1100	17	15	10

Machine Learning

Multiple features



Building ID	Electricity Use	Water Use (L/day)	Waste Output	Solar Coverage	Building Age (years)
1	320	900	14	10	8
2	180	600	8	40	3
3	450	1200	20	5	15
4	200	700	9	35	5
5	150	500	6	60	2
6	380	1000	15	20	12
7	520	1300	22	0	18
8	240	650	10	30	4
9	130	480	5	70	1
10	410	1100	17	15	10

Machine Learning

Multiple features

Building ID	Electricity Use	Water Use (L/day)	Waste Output	Solar Coverage	Building Age	Label
1	320	900	14	10	8	?
2	180	600	8	40	3	?
3	450	1200	20	5	15	?
4	200	700	9	35	5	?
5	150	500	6	60	2	?
6	380	1000	15	20	12	?
7	520	1300	22	0	18	?
8	240	650	10	30	4	?
9	130	480	5	70	1	?
10	410	1100	17	15	10	?

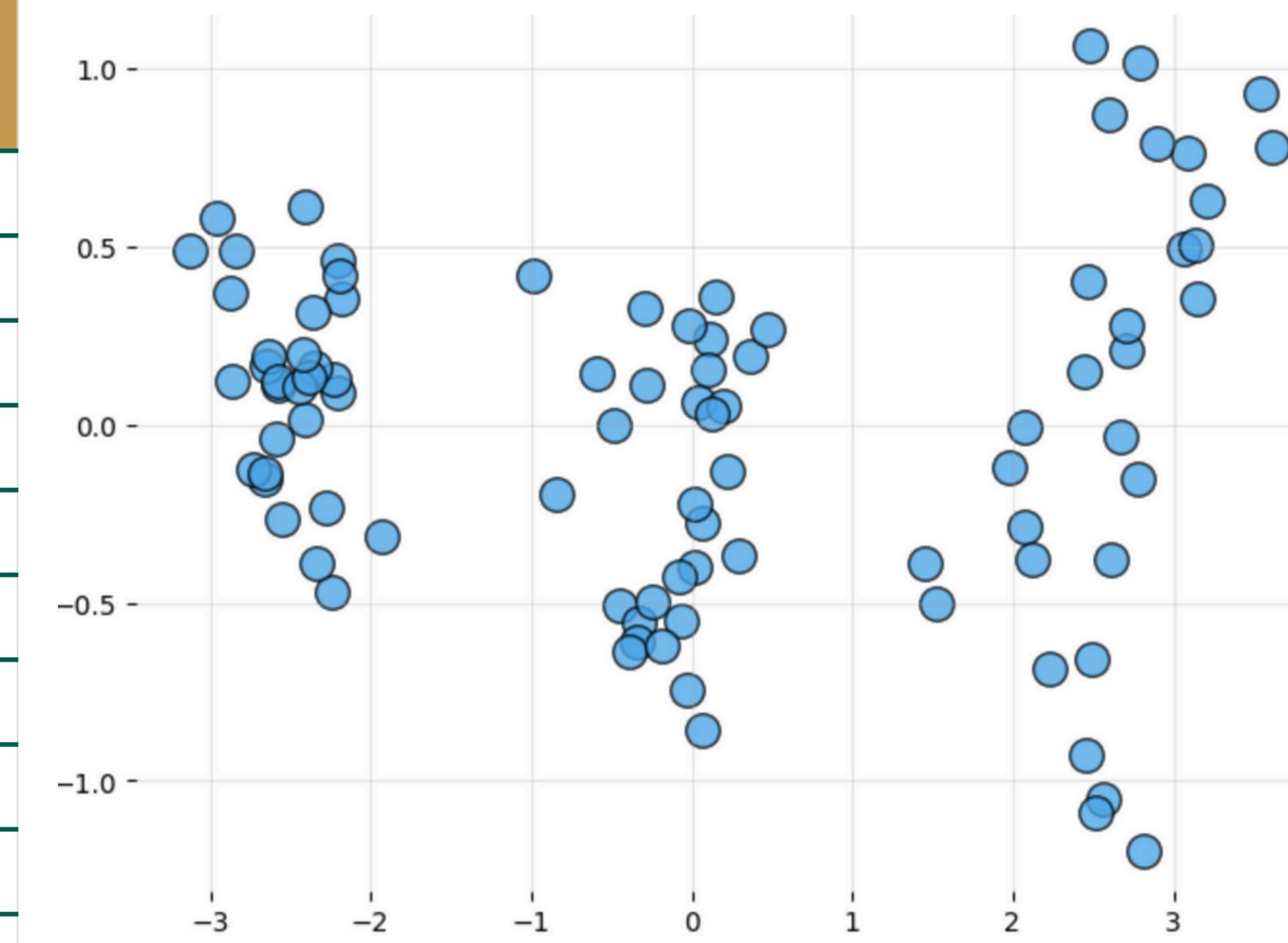


Can a model learn from
data without labels?

Machine Learning

Building ID	Electricity Use (kWh/day)	Water Use (L/day)	Waste Output (kg/day)	Solar Coverage (%)	Building Age (years)
1	320	900	14	10	8
2	180	600	8	40	3
3	450	1200	20	5	15
4	200	700	9	35	5
5	150	500	6	60	2
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9	130	480	5	70	1
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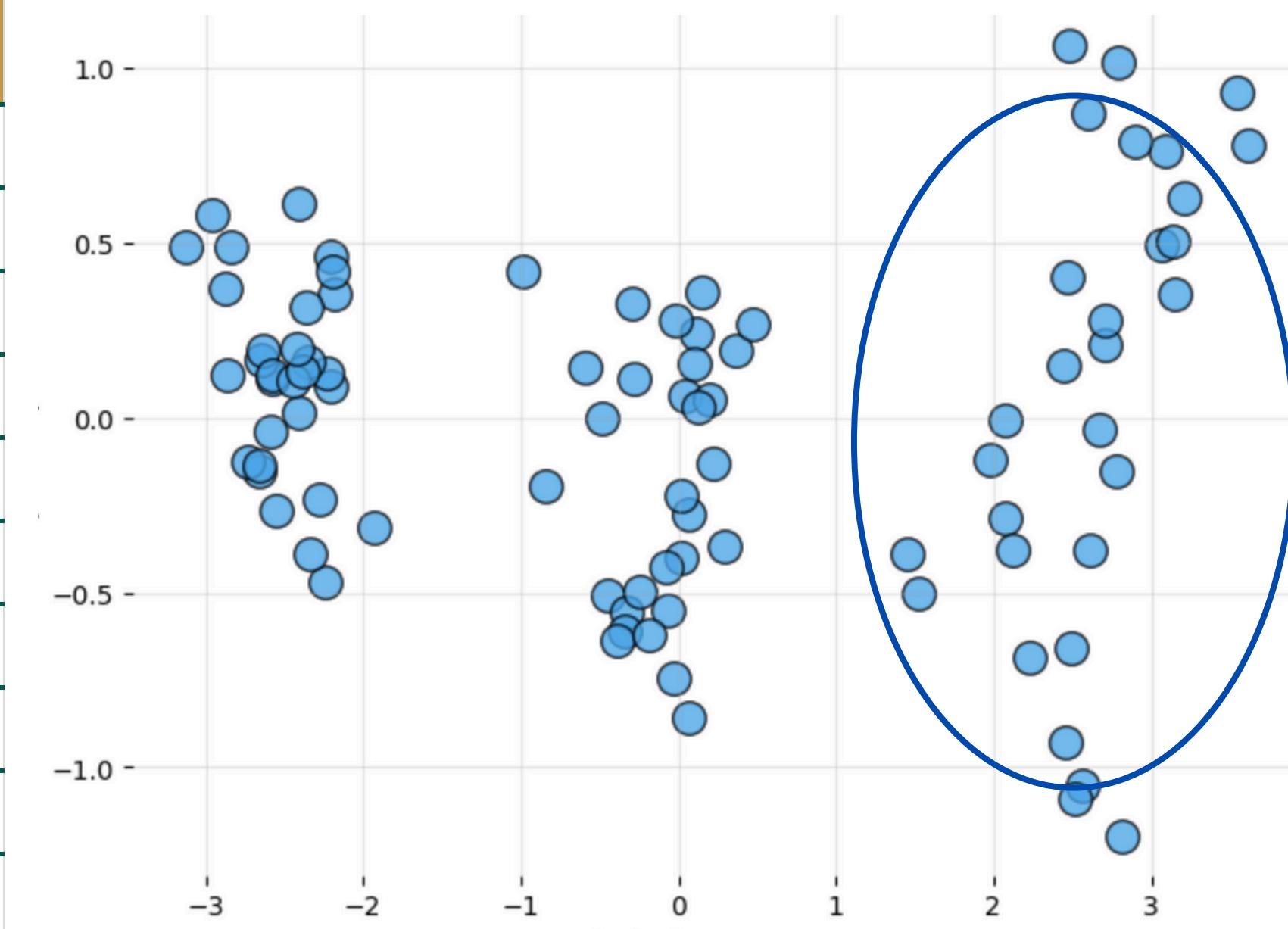
What does this plot tell us?



Machine Learning

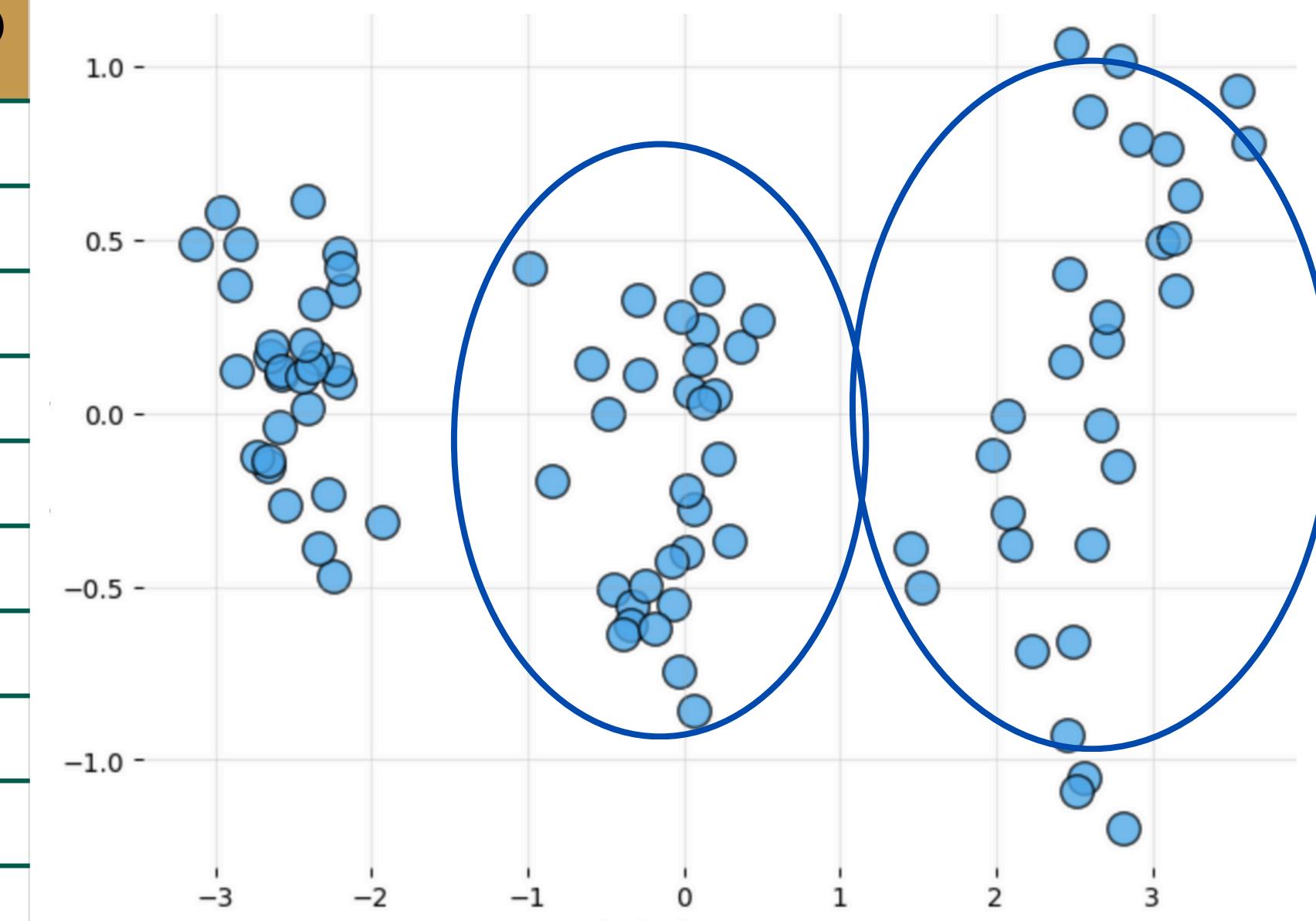
Building ID	Electricity Use (kWh/day)	Water Use (L/day)	Waste Output (kg/day)	Solar Coverage (%)	Building Age (years)
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7	520	1300	22	0	18
8	240	650	10	30	4
9	130	480	5	70	1
10	410	1100	17	15	10

Buildings that appear close together have similar resource usage patterns



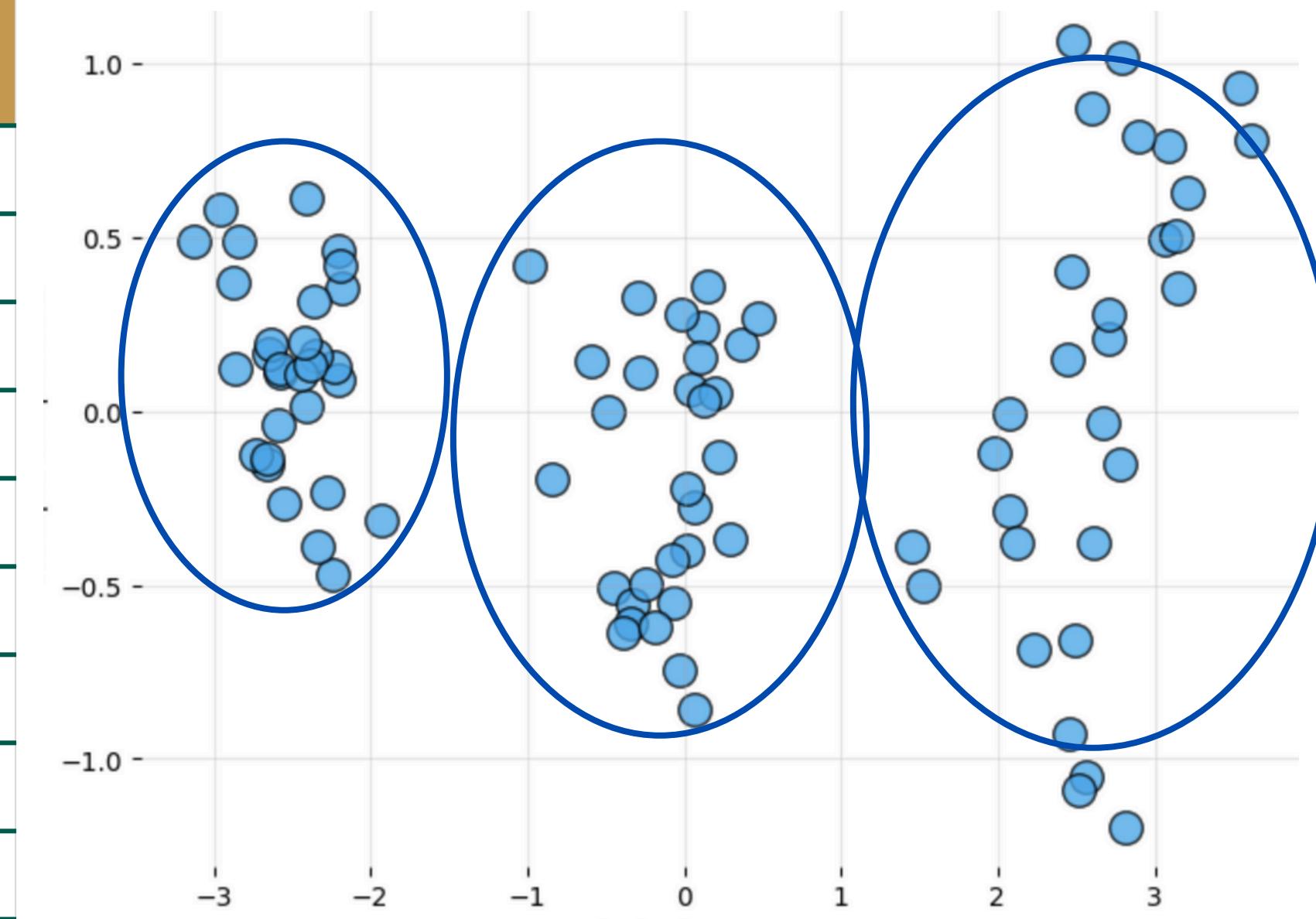
Machine Learning

Building ID	Electricity Use (kWh/day)	Water Use (L/day)	Waste Output (kg/day)	Solar Coverage (%)	Building Age (years)
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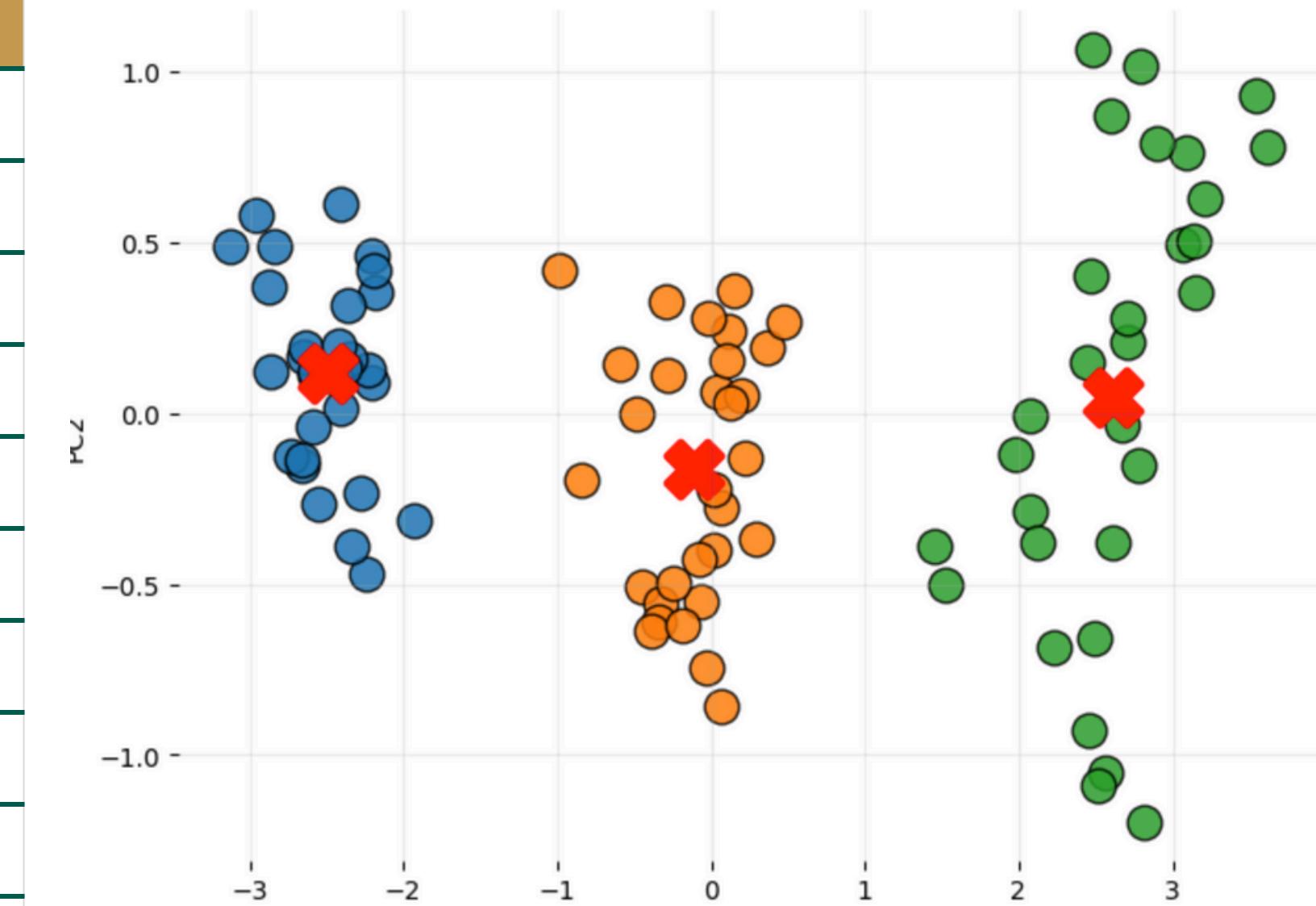
Machine Learning

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Machine Learning

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8	240	650	10	30	4
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Machine Learning

Supervised Machine Learning

»» Problem 1:

Predicting home price

Regression

An ML task where the goal is to predict a continuous numerical value.

»» Problem 2:

Classify the customer segment

Classification

An ML task where the goal is to assign each input to a predefined category.

Unsupervised Machine Learning

»» Problem 3:

Discovering groups of buildings based on sustainability usage

Clustering

An ML task where the goal is to discover natural patterns or groups

Artificial Intelligence

Hands-On Activity

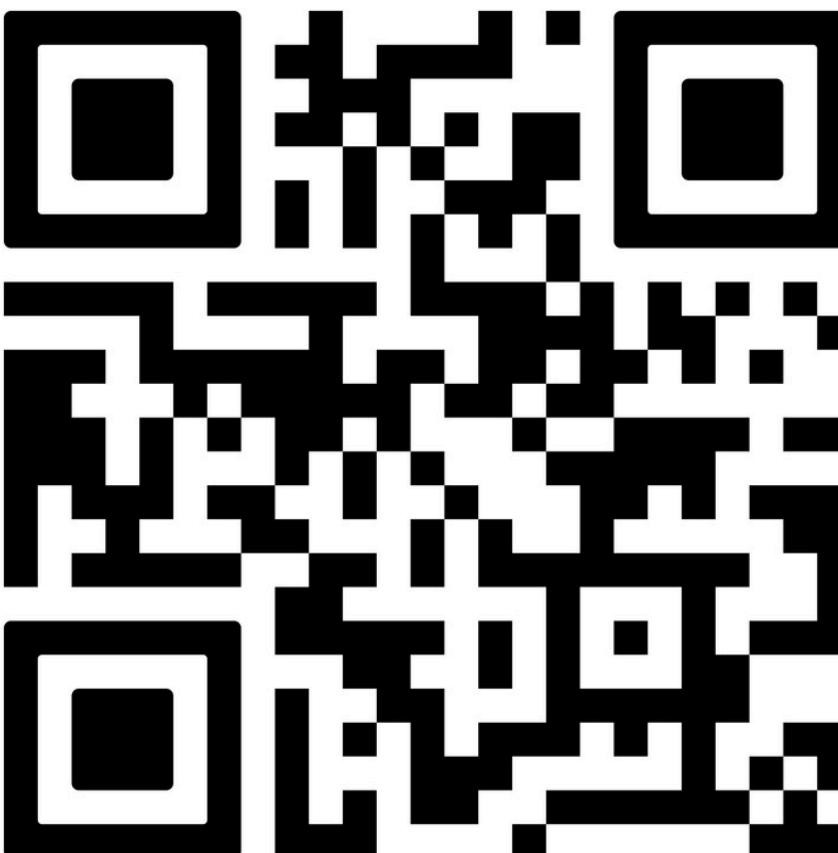
Hands-On Activity

Saudi Arabia Social Development Bank Loans 2019



Hands-On Activity

Work-Life Balance and Longevity Dataset



A graphic icon consisting of two white speech bubbles with dark green outlines. The left bubble contains the letter 'Q' and the right bubble contains the letter 'A', representing a question and answer pair.

Q A

Thank You