Machine Learning Models – 3 Types

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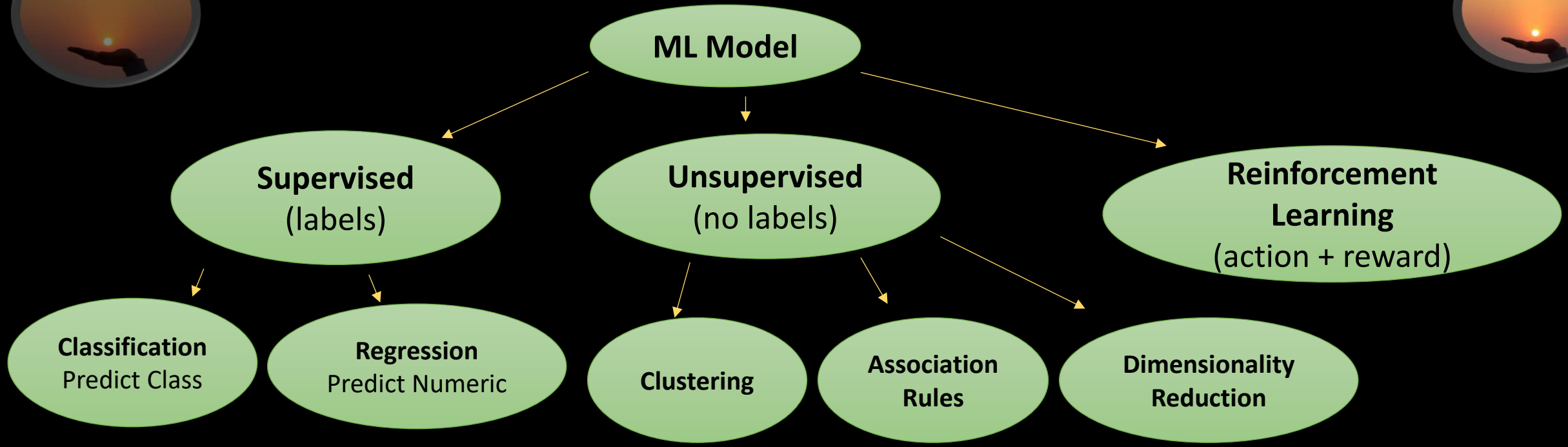


1) Supervised learning: There are two types of problems that we want to predict commonly, they are Classification and Regression problems.

In classification, we predict **categorical** values:

Is customer going to default on loan: yes or no, 0 or 1;

BP is high, low or medium;

Type of iris flower: Setosa, Versicolor, Virginica;

Is it going to rain today: y/n; What type of disease a patient might have, etc

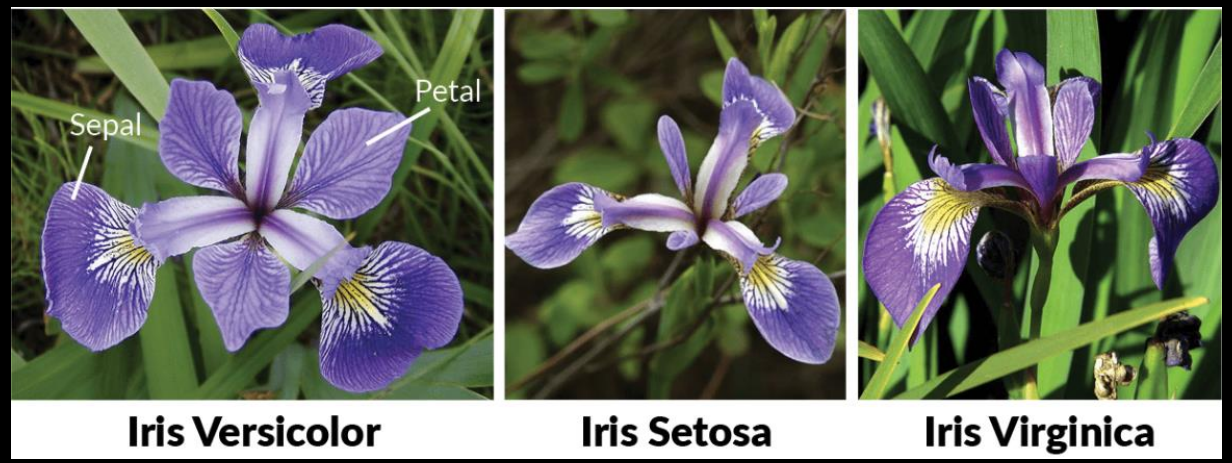
Classification:

What type of weather condition ?

	A	B	C	D	E	F	G	H
	date	precipitation	temp_max	temp_min	wind	weather		
	1/1/2012	0	12.8	5	4.7	drizzle		
	1/2/2012	10.9	10.6	2.8	4.5	rain		
	1/3/2012	0.8	11.7	7.2	2.3	rain		
	1/4/2012	20.3	12.2	5.6	4.7	rain		
	1/5/2012	1.3	8.9	2.8	6.1	rain		
	1/6/2012	2.5	4.4	2.2	2.2	rain		
	1/7/2012	0	7.2	2.8	2.3	rain		
	1/8/2012	0	10	2.8	2	sun		
	1/9/2012	4.3	9.4	5	3.4	rain		
	1/10/2012	1	6.1	0.6	3.4	rain		
	1/11/2012	0	6.1	-1.1	5.1	sun		
	1/12/2012	0	6.1	-1.7	1.9	sun		
	1/13/2012	0	5	-2.8	1.3	sun		
	1/14/2012	4.1	4.4	0.6	5.3	snow		
	1/15/2012	5.3	1.1	-3.3	3.2	snow		
	1/16/2012	2.5	1.7	-2.8	5	snow		
	1/17/2012	8.1	3.3	0	5.6	snow		
	1/18/2012	19.8	0	-2.8	5	snow		
	1/19/2012	15.2	-1.1	-2.8	1.6	snow		
	1/20/2012	13.5	7.2	-1.1	2.3	snow		
	1/21/2012	3	8.3	3.3	8.2	rain		
	1/22/2012	6.1	6.7	2.2	4.8	rain		
	1/23/2012	0	8.3	1.1	3.6	rain		
	1/24/2012	8.6	10	2.2	5.1	rain		
	1/25/2012	8.1	8.9	4.4	5.4	rain		

Classification:
What type of flower ?

SepalLength	SepalWidth	PetalLength	PetalWidth	Species
5.1	3.5	1.4	0.2	Iris-setosa
4.9	3	1.4	0.2	Iris-setosa
4.7	3.2	1.3	0.2	Iris-setosa
4.6	3.1	1.5	0.2	Iris-setosa
7	3.2	4.7	1.4	Iris-versicolor
6.4	3.2	4.5	1.5	Iris-versicolor
6.9	3.1	4.9	1.5	Iris-versicolor
5.5	2.3	4	1.3	Iris-versicolor
6.3	3.3	6	2.5	Iris-virginica
5.8	2.7	5.1	1.9	Iris-virginica
7.1	3	5.9	2.1	Iris-virginica



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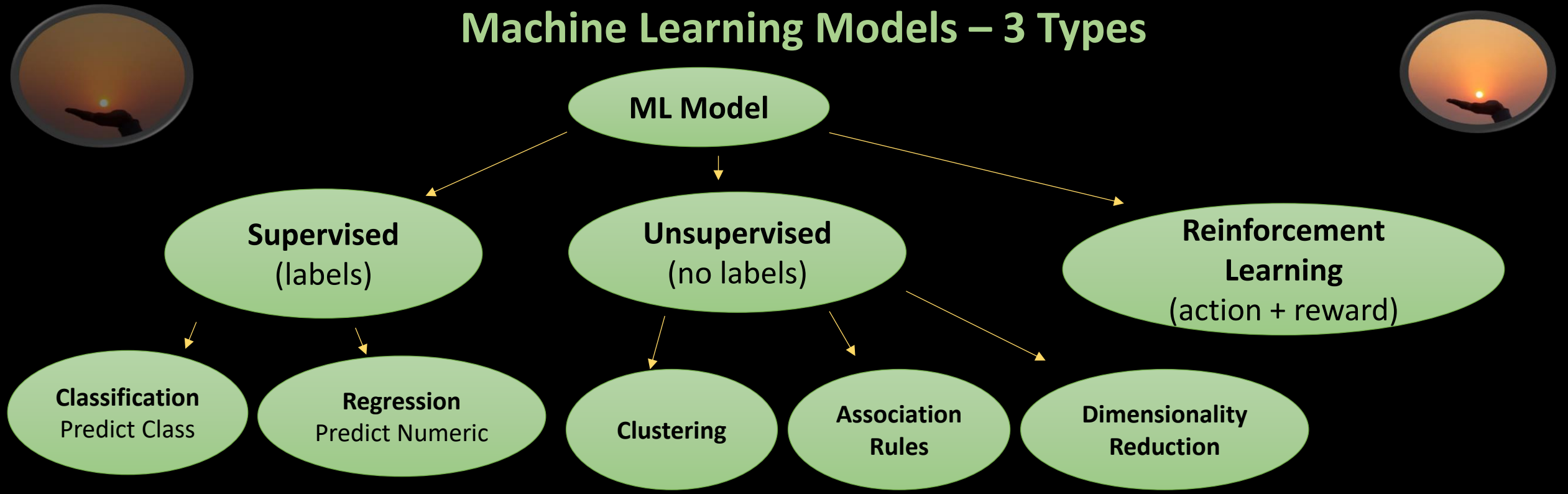


In regression, we predict **continuous** values:

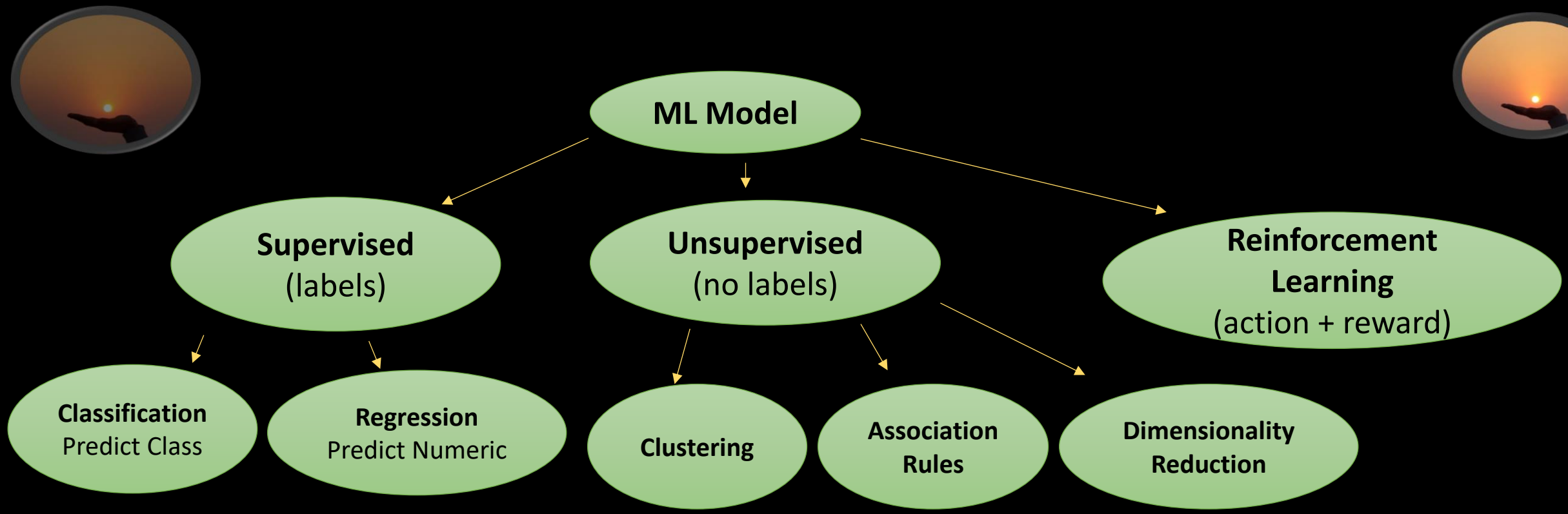
Predict House price

Predict Number of bike-rentals

Predict Probability of rain today, etc.

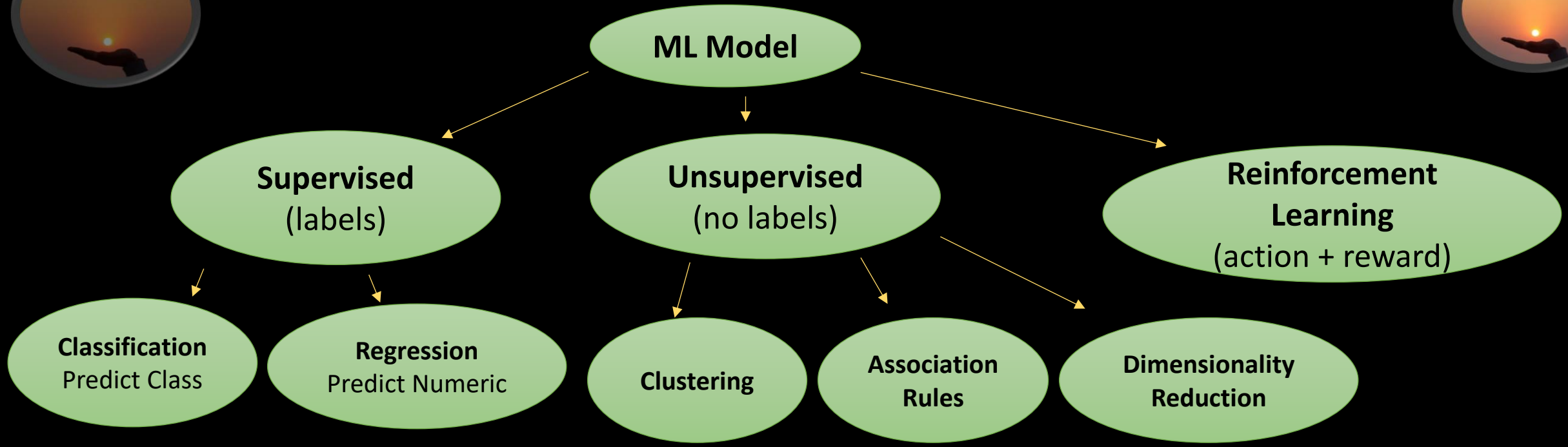
Regression: Predict Number of bike-rentals

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	day	mnth	year	season	holiday	weekday	workingda	weathersi	temp	atemp	hum	windspee	rentals
2	1	1	2011	1	0	6	0	2	0.344167	0.363625	0.805833	0.160446	331
3	2	1	2011	1	0	0	0	2	0.363478	0.353739	0.696087	0.248539	131
4	3	1	2011	1	0	1	1	1	0.196364	0.189405	0.437273	0.248309	120
5	4	1	2011	1	0	2	1	1	0.2	0.212122	0.590435	0.160296	108
6	5	1	2011	1	0	3	1	1	0.226957	0.22927	0.436957	0.1869	82
7	6	1	2011	1	0	4	1	1	0.204348	0.233209	0.518261	0.089565	88
8	7	1	2011	1	0	5	1	2	0.196522	0.208839	0.498696	0.168726	148
9	8	1	2011	1	0	6	0	2	0.165	0.162254	0.535833	0.266804	68
10	9	1	2011	1	0	0	0	1	0.138333	0.116175	0.434167	0.36195	54
11	10	1	2011	1	0	1	1	1	0.150833	0.150888	0.482917	0.223267	41
12	11	1	2011	1	0	2	1	2	0.169091	0.191464	0.686364	0.122132	43
13	12	1	2011	1	0	3	1	1	0.172727	0.160473	0.599545	0.304627	25
14	13	1	2011	1	0	4	1	1	0.165	0.150883	0.470417	0.301	38



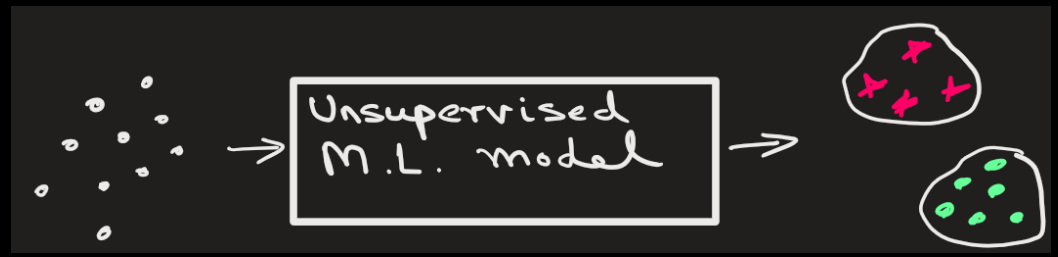
2) Unsupervised learning:

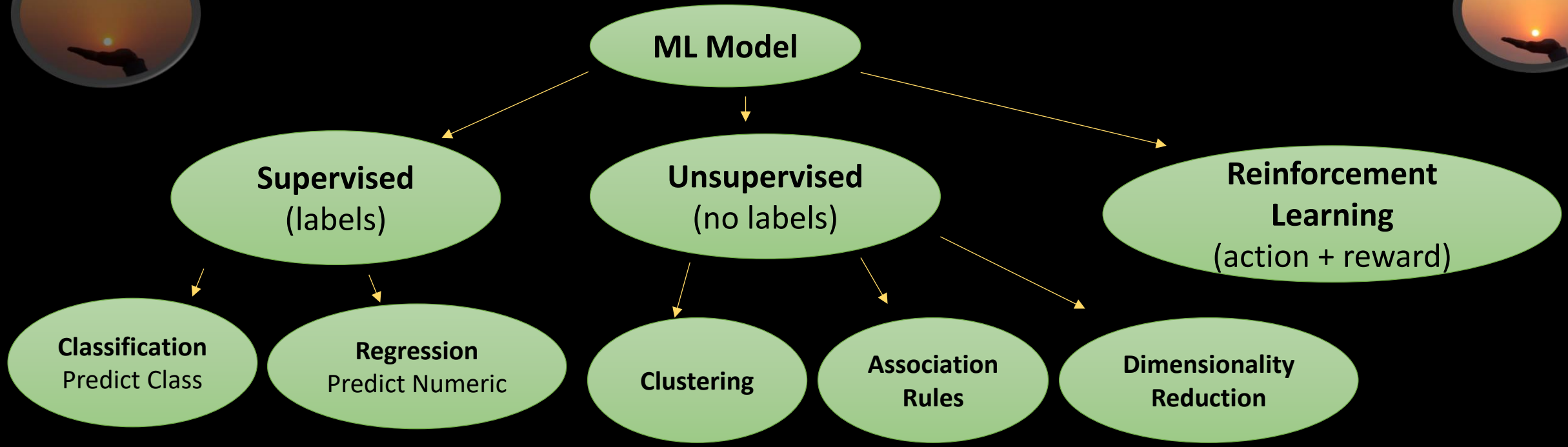
Discover hidden patterns, structures, or relationships in unlabeled data.



2) Unsupervised learning:

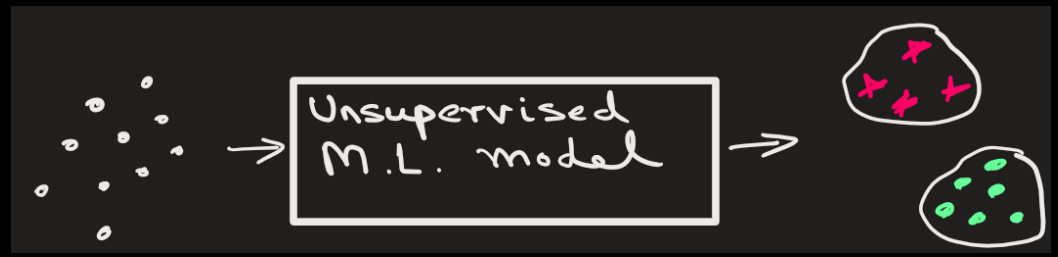
Example In Customer segmentation: A retail company might group its customers based on **buying habits, browsing patterns, and demographics** to create targeted marketing campaigns.

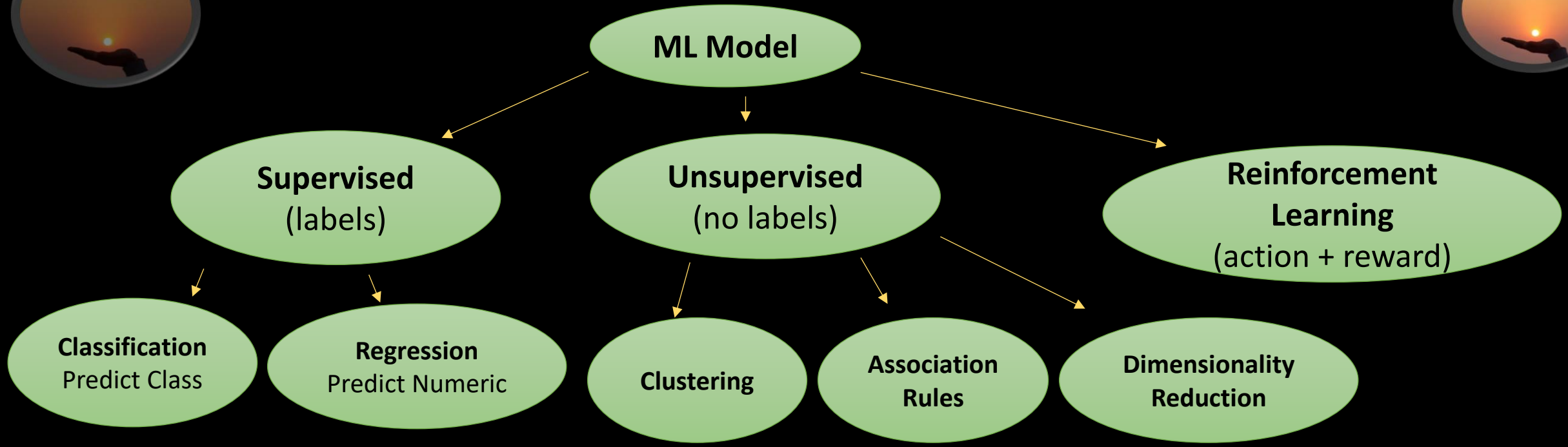




2) Unsupervised learning:

Example In Bioinformatics: Clustering is used to group genes with similar expression profiles to identify underlying biological relationships.

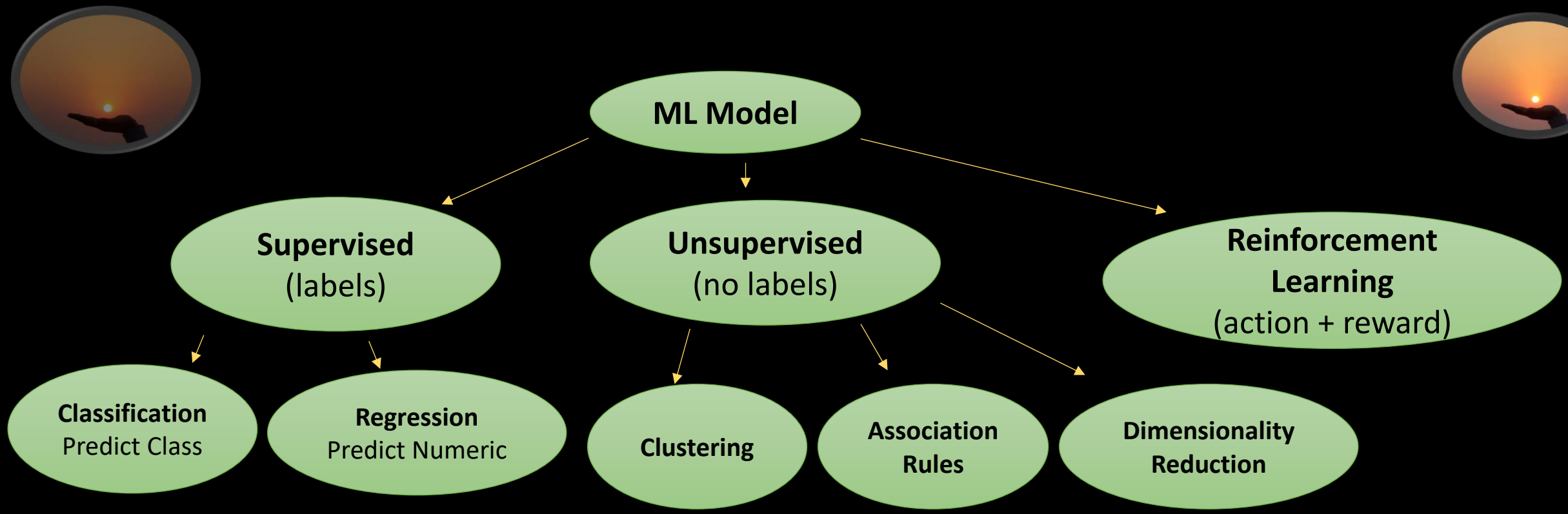




2) Unsupervised learning:

Example in Associations: This involves finding relationships and co-occurrences between items in a dataset.

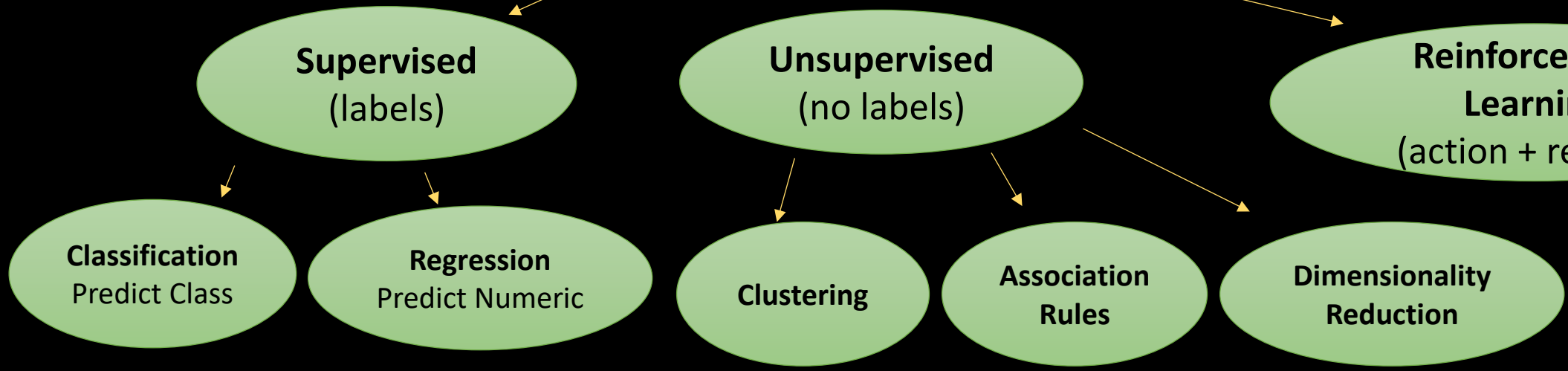
Market basket analysis: A retailer can discover that **customers who buy bread frequently also buy milk, jam and butter.** This information can be used to optimize product placement and promotions.



2) Unsupervised learning:

Example in Associations - Recommendation engines: Streaming services use association rules to suggest movies or music to users based on their historical behavior and what others with similar tastes have consumed.

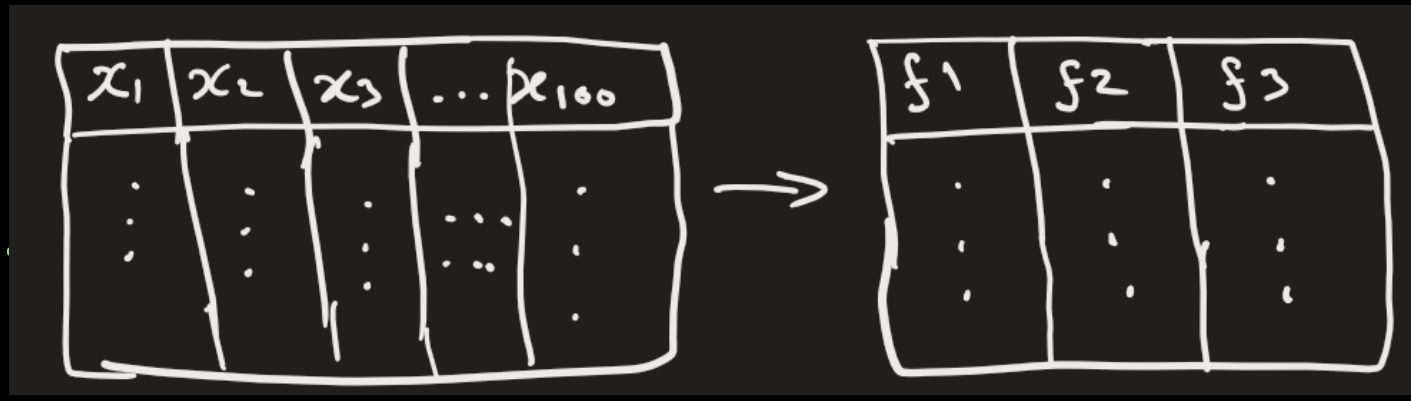
For example, if you have seen Predator, Aliens, Interstellar, then recommendation engine may recommend you sci-fi genre - gravity, etc.



2) Unsupervised learning:

Example in Dimension Reduction:

It attempts to reduce the number of dimension, AKA features, in the data.



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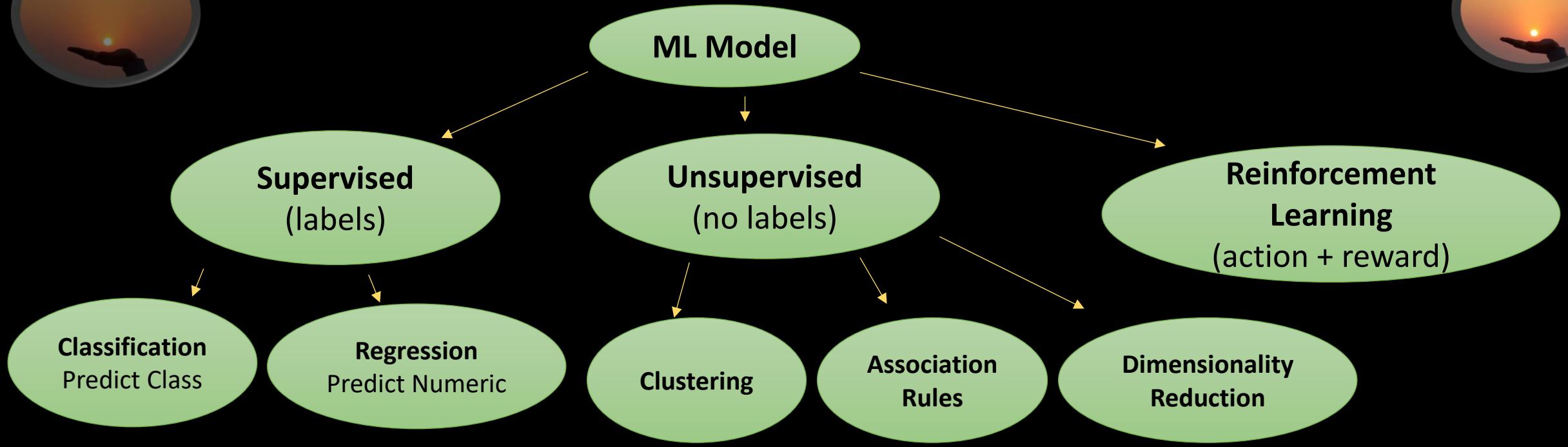

3) Reinforcement Learning:

Train an **agent** to make a sequence of decisions in an **environment** to maximize a **reward**.

Examples: Robotics, Self driving cars, video games, etc.

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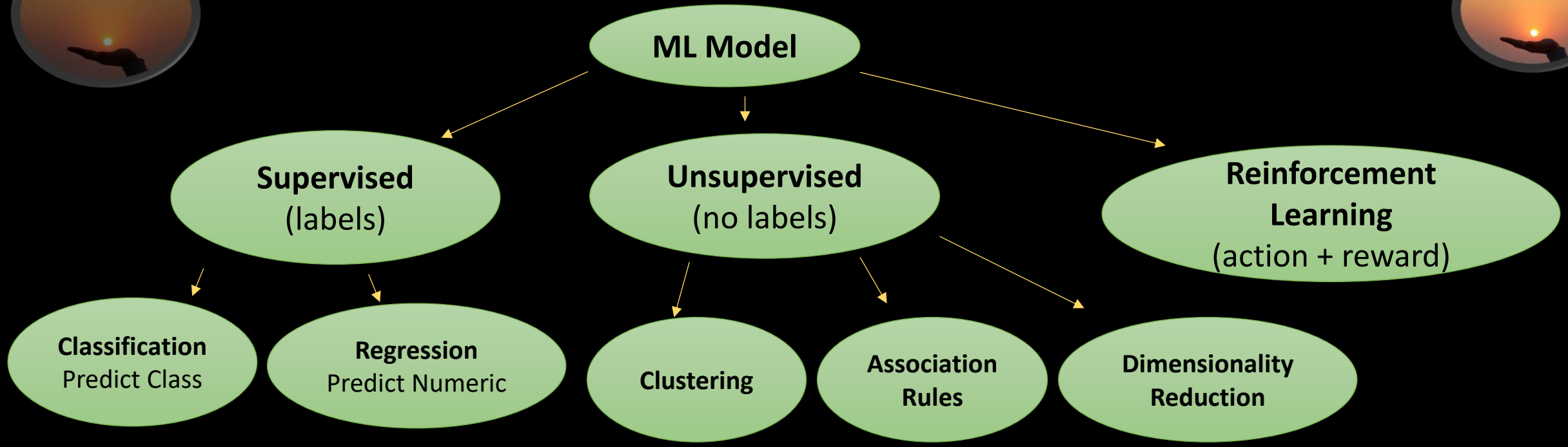

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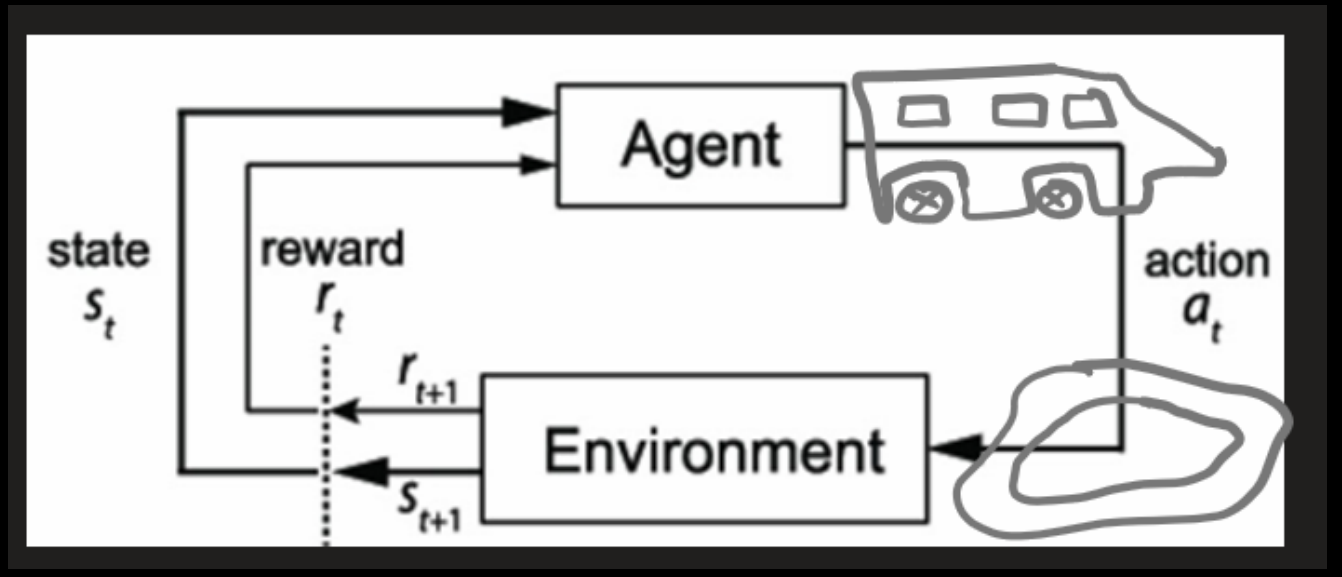

EXTRA

Task: Make a ML model that would become expert on Iris flower. You are given data of Iris flower.

The ML model should be able to recognize the type of flower (Setosa, Versicolor or Virginica) based on input: sepal and petal dimensions

SepalLength	SepalWidth	PetalLength	PetalWidth	Species
5.1	3.5	1.4	0.2	Iris-setosa
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6.3	3.3	6	2.5	Iris-virginica
5.8	2.7	5.1	1.9	Iris-virginica
7.1	3	5.9	2.1	Iris-virginica