Unit-1

Introduction

Well posed learning problems

- A computer program is said to learn from experience E in context to some task T and some performance measure P, if its performance on T, as was measured by P, upgrades with experience E.

Well posed learning problems

- **To better filter emails as spam or not**
  - Task – Classifying emails as spam or not
  - Performance Measure – The fraction of emails accurately classified as spam or not spam
  - Experience – Observing you label emails as spam or not spam

Well posed learning problems

- **Handwriting Recognition Problem**
  - Task – Acknowledging handwritten words within portrayal
  - Performance Measure – percent of words accurately classified
  - Experience – a directory of handwritten words with given classifications

Well posed learning problems

- **Fruit Prediction Problem**
  - Task – forecasting different fruits for recognition
  - Performance Measure – able to predict maximum variety of fruits
  - Experience – training machine with the largest datasets of fruits images

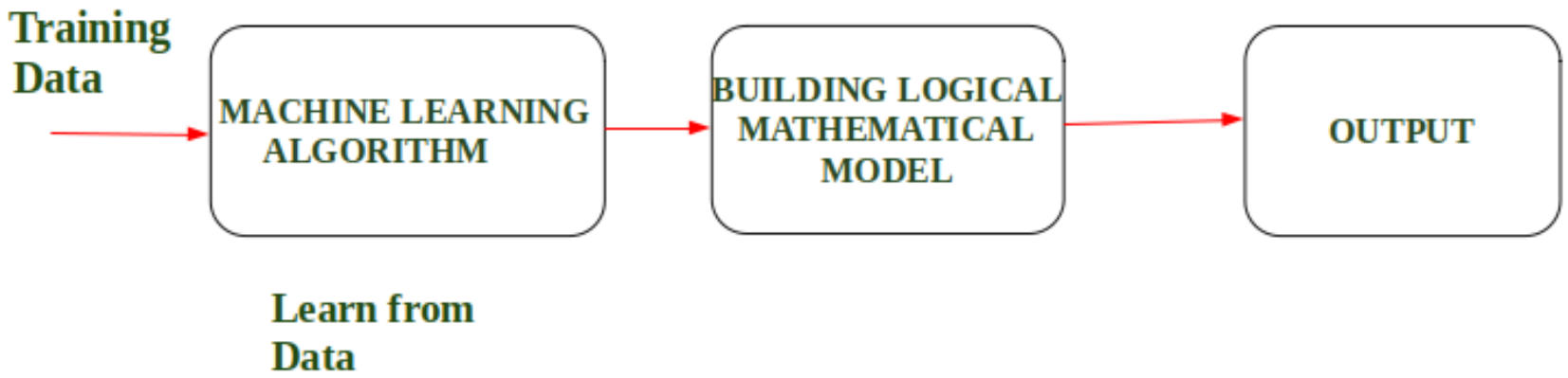
Well posed learning problems

- **Face Recognition Problem**
  - Task – predicting different types of faces
  - Performance Measure – able to predict maximum types of faces
  - Experience – training machine with maximum amount of datasets of different face images

Design a Learning System in Machine Learning

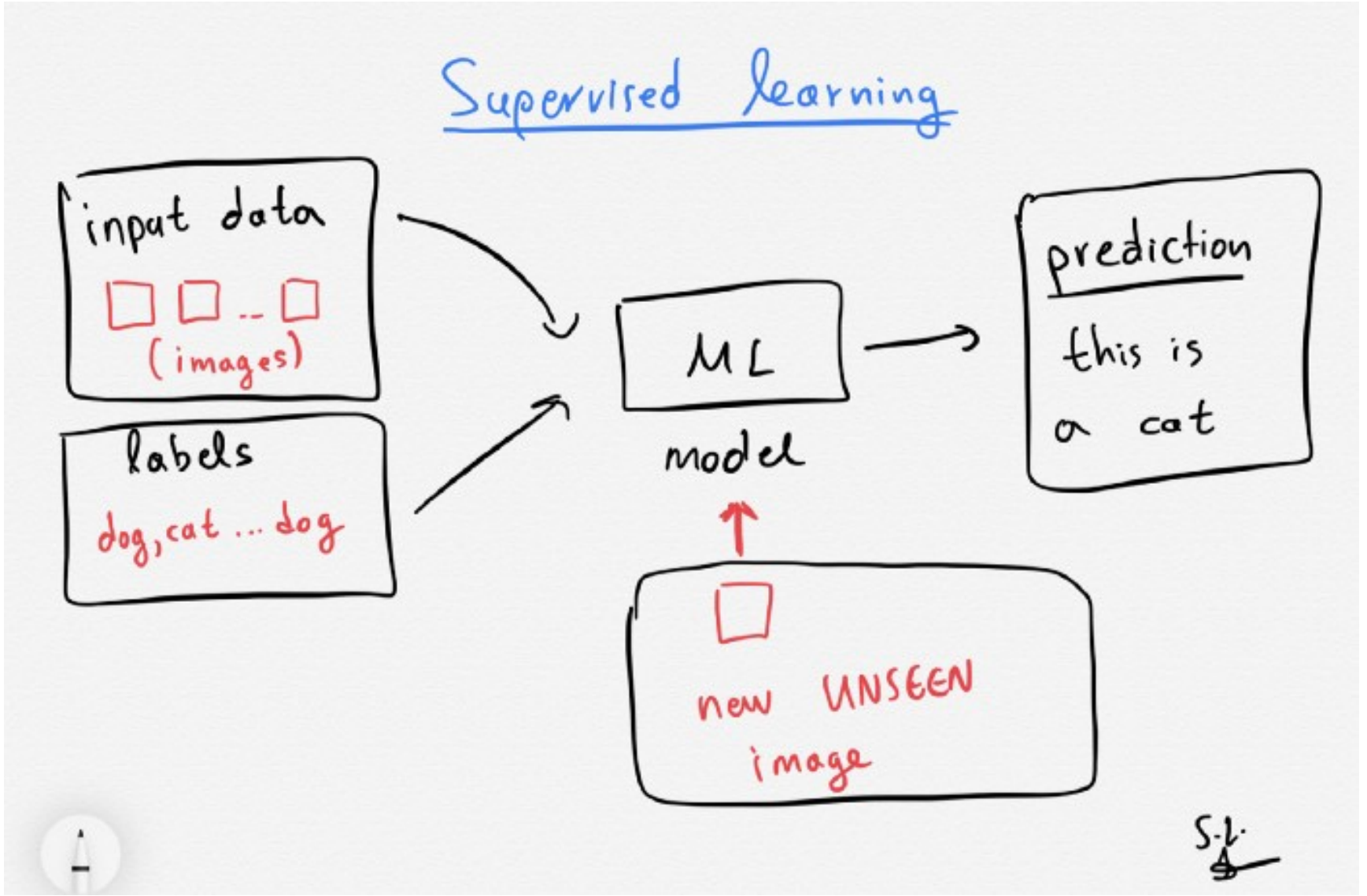
Learning System Design

- According to Arthur Samuel "Machine Learning enables a Machine to Automatically learn from Data, Improve performance from an Experience and predict things without explicitly programmed."



Supervised Learning

- Supervised learning, as the name indicates, has the presence of a **supervisor** as a teacher. Basically supervised learning is when we teach or **train the machine using data** that is well labeled. Which means some data is already tagged with the correct answer.
- After that, the machine is provided with a new set of examples(data) so that the supervised learning algorithm analyses the training data(set of training examples) and produces a correct outcome from labeled data.


Supervised learning
input data
(images)
labels
dog, cat ... dog
ML
model
prediction
this is
a cat
new UNSEEN
image
S.L.

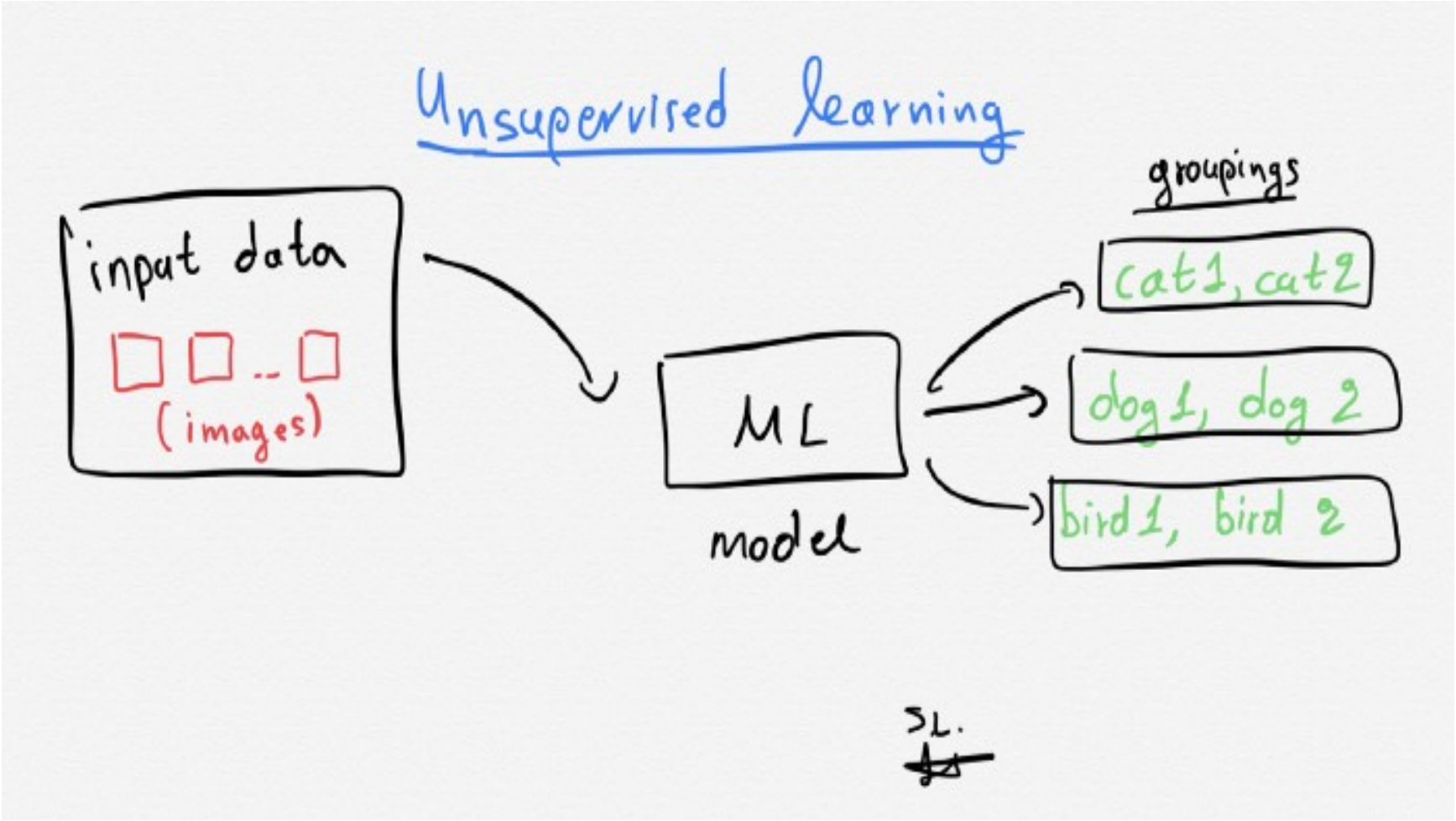
Example

Supervised Learning Methods

- Regression
- Logistic Regression
- Naive Bayes Classifiers
- K-NN (k nearest neighbors)
- Decision Trees
- Support Vector Machine

Unsupervised Learning

- Unsupervised learning is the training of a machine using information that is neither classified nor labeled and allowing the algorithm to act on that information without guidance. Here the task of the machine is to group unsorted information according to similarities, patterns, and differences without any prior training of data.

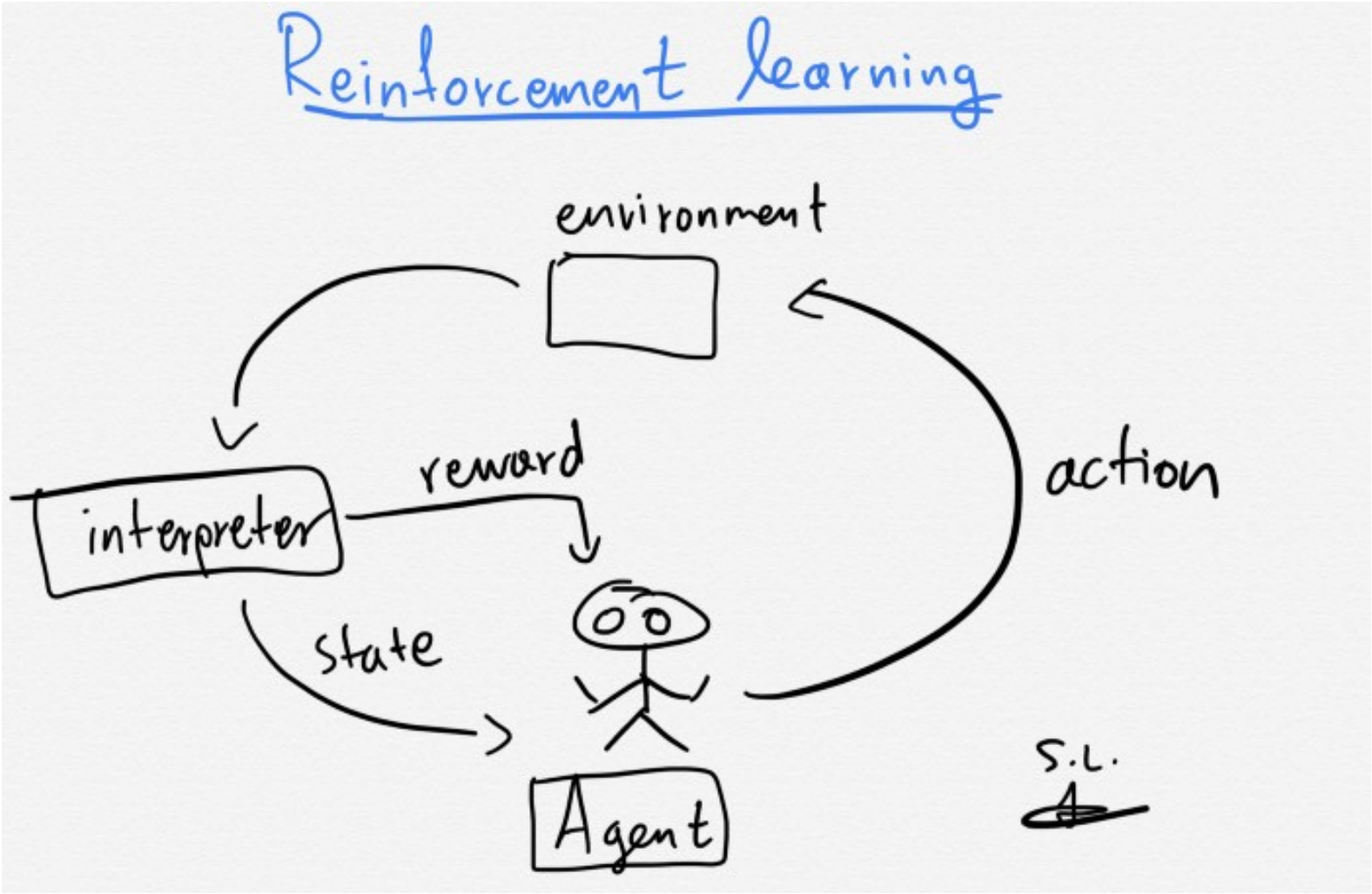

Unsupervised learning
input data
(images)
ML
model
groupings
cat 1, cat 2
dog 1, dog 2
bird 1, bird 2
SL.

Unsupervised Learning Methods

- Hierarchical clustering
- K-means clustering
- Principal Component Analysis
- Singular Value Decomposition
- Independent Component Analysis

Reinforcement learning

- Reinforcement learning is an area of Machine Learning. It is about taking suitable action to maximize reward in a particular situation.
- It is employed by various software and machines to find the best possible behavior or path it should take in a specific situation.
- Reinforcement learning, there is no answer but the reinforcement agent decides what to do to perform the given task. In the absence of a training dataset, it is bound to learn from its experience.


Reinforcement learning
environment
interpreter
reward
action
state
Agent
S.L.

Reinforcement learning methods

- **State-Action-Reward-State-Action (SARSA)**
- **Deep Deterministic Policy Gradient (DDPG)**

Comparison

Criteria	**Supervised ML**	**Unsupervised ML**	**Reinforcement ML**
Definition	Learns by using labelled data	Trained using unlabelled data without any guidance.	Works on interacting with the environment
Type of data	Labelled data	Unlabelled data	No – predefined data
Type of problems	Regression and classification	Association and Clustering	Exploitation or Exploration
Supervision	Extra supervision	No supervision	No supervision
Algorithms	Linear Regression, Logistic Regression, SVM, KNN etc.	K – Means, C – Means, Apriori	Q – Learning, SARSA
Aim	Calculate outcomes	Discover underlying patterns	Learn a series of action
Application	Risk Evaluation, Forecast Sales	Recommendation System, Anomaly Detection	Self Driving Cars, Gaming, Healthcare

References

- https://www.geeksforgeeks.org/supervised-unsupervised-learning/
- https://www.aitude.com/supervised-vs-unsupervised-vs-reinforcement/