



# Module 9 Part 4

## Machine Learning

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  - What is Machine Learning (ML)?
  - Applications of ML
- Different types of ML
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- Steps to build a ML model
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- Popular tools for ML

What is ML?

ML is the ability of machines to **detect patterns** and perform activities that humans do:

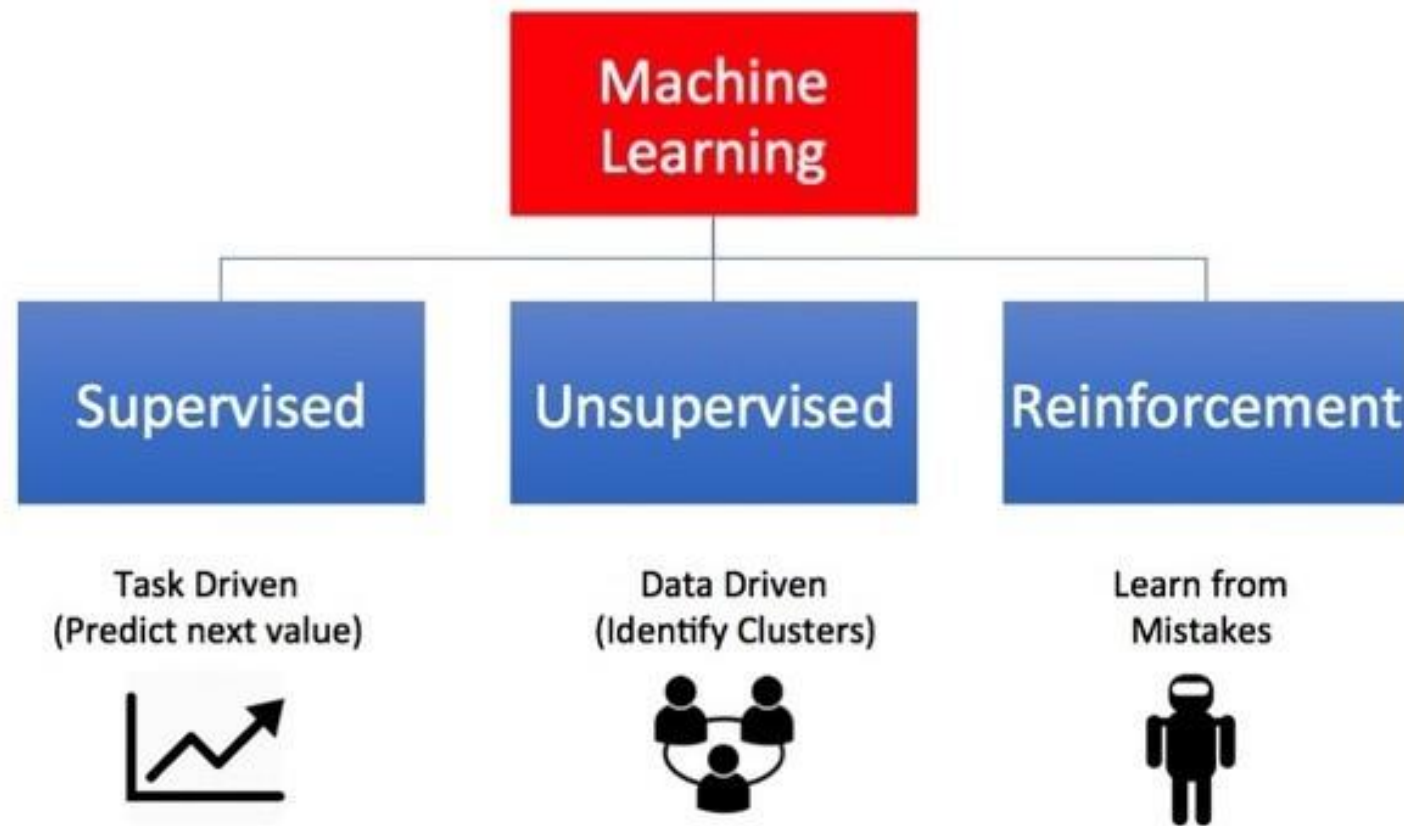
Applications

- Determine treatment for a patient based on their genetic makeup, demographic (age, gender, ethnicity) and psychographic characteristics (lifestyle, attitude, values)
- Pro-active maintenance of industrial equipment by looking at health parameters such as temperature, vibration, oil level
- Credit card Fraud detection by looking at spend frequency, amount, time of day, place of transaction, product purchased, customer profile

# Major types of machine learning



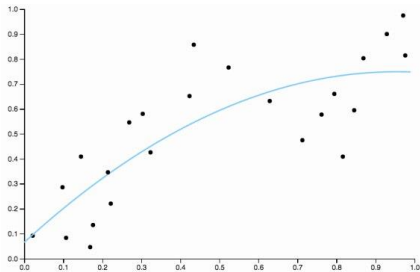
## Types of Machine Learning



# Some algorithms used in ML

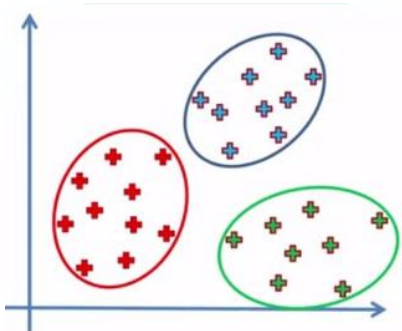


## Regression



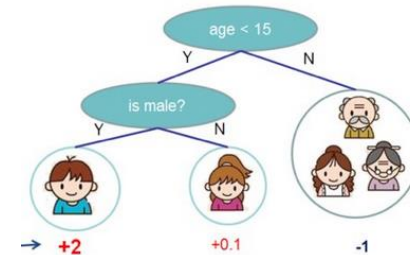
Eg. Predict price of house given size, location, etc.

## Clustering

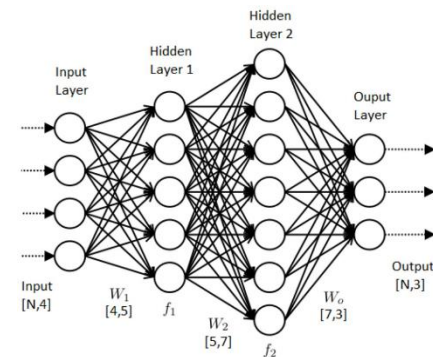


## Decision tree

Does the person like computer games



## Neural networks

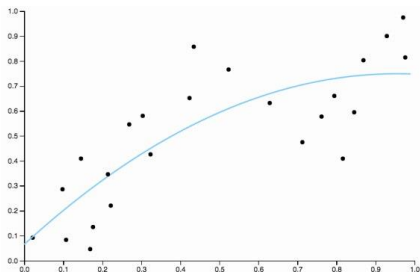


# Supervised learning



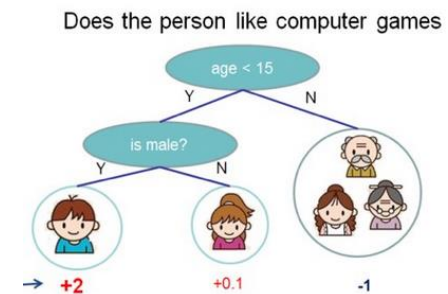
- **Supervised:** In this approach, we provide a labelled dataset to the machine.
- Labelled dataset consists of features and result or class.
- Using the dataset, the machine builds a model (an equation or structure) to predict.

## Regression



Eg. Predict price of house given size, location, etc.

## Decision tree



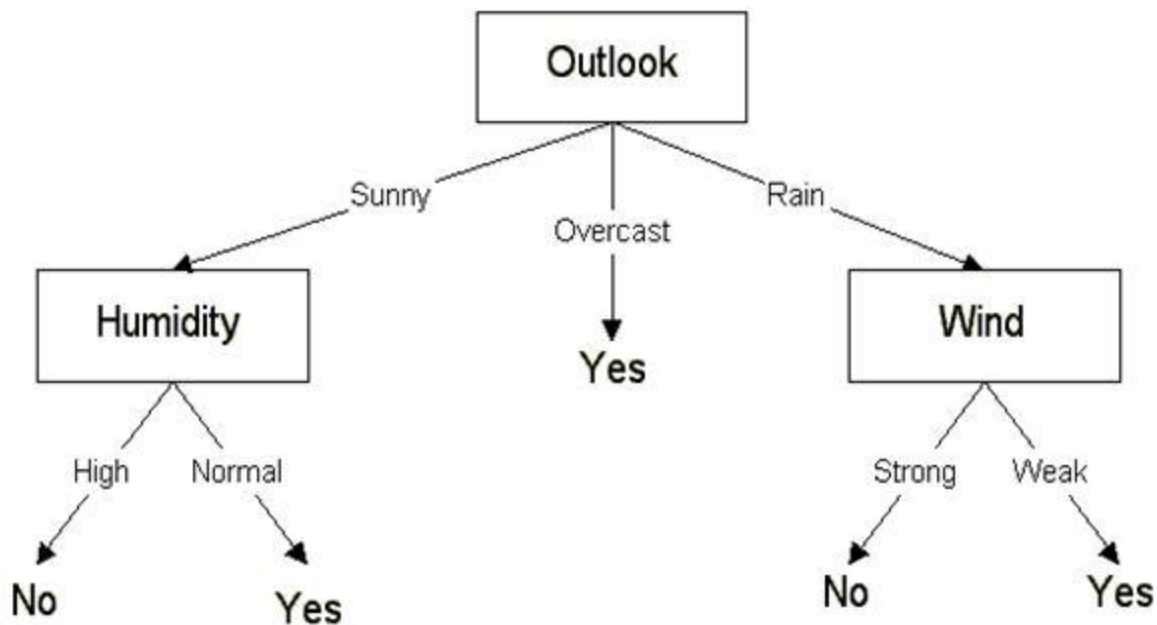
Eg. Does this person like computer game? (based on age and gender)

# Decision tree: Data provided to algorithm



Day	Outlook	Temperature	Humidity	Wind	Play Golf
D1	Sunny	Hot	High	Weak	No
D2	Sunny	Hot	High	Strong	No
D3	Overcast	Hot	High	Weak	Yes
D4	Rain	Mild	High	Weak	Yes
D5	Rain	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Strong	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cool	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

# Decision tree built by algorithm to predict whether to play or not

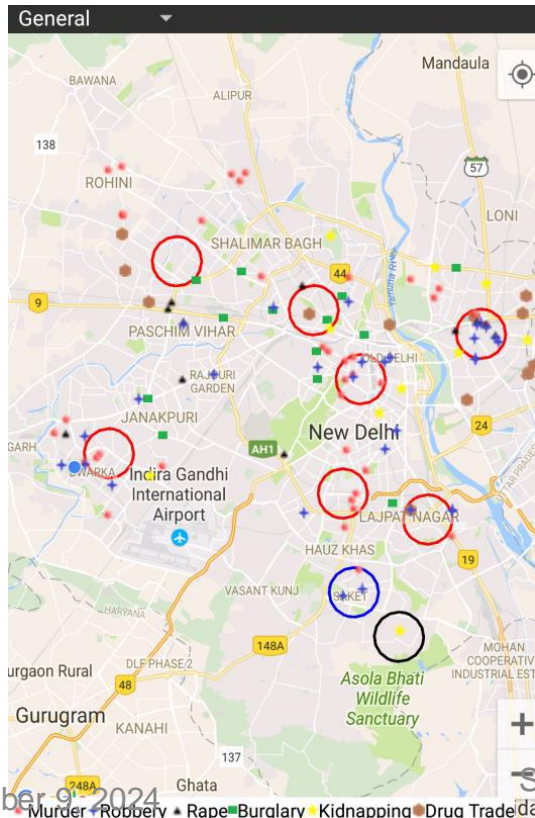




# Unsupervised Learning



- **Unsupervised:** Here we have an unlabelled dataset. We do not know what all features will constitute a class. The machine learns by itself and builds a model.



Circles indicates clusters of crime areas in Delhi

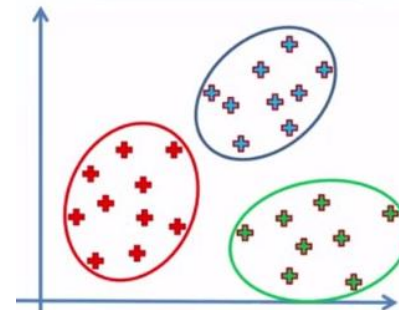
Ref: Crime Prediction using K-means Algorithm:  
Global Research and Development Journal for Engineering |  
Volume 2 | Issue 5 | April 2017  
Architectures

# Clustering



- Customers can be segmented (clustered) based on Gender, age, annual income, products purchased, etc. (Luxury car buyers)
- We can source potential customer data and determine to which segment they belong to.
- Based on the segment, we can target them and send promotion details for the right product

## Clustering



# Reinforcement Learning

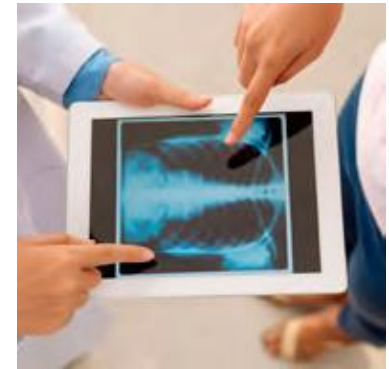


- ***Reinforcement Learning:*** In this, the machine learns from the environment by interacting with it.
- The machine is provided a set of allowed actions, rules and potential end states.
- By exploring different actions and observing resulting reactions the machine learns to exploit the rules to create a desired outcome.
- Eg. Game of chess, Robotics
- Algorithms used: Neural networks, Learning Automata, Q-Learning, Markov decision process

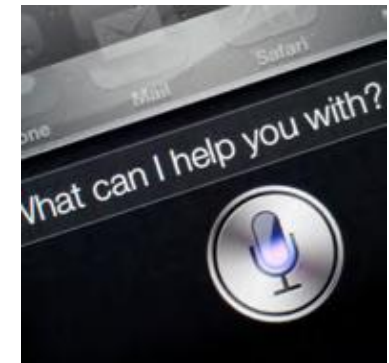
# Deep Learning



- Deep learning: Used to understand and analyse image, sound and video. Uses Neural networks



- Used to understand human language (Natural Language Processing - NLP). Eg. Chatbots



# Neural networks

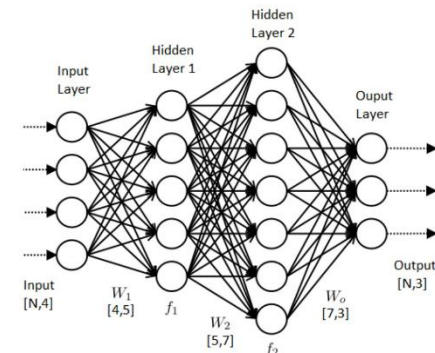


- These networks can learn and model the relationships between inputs and outputs that are complex.
- **Examples:** Detecting rare events such as frauds, help doctors with an opinion

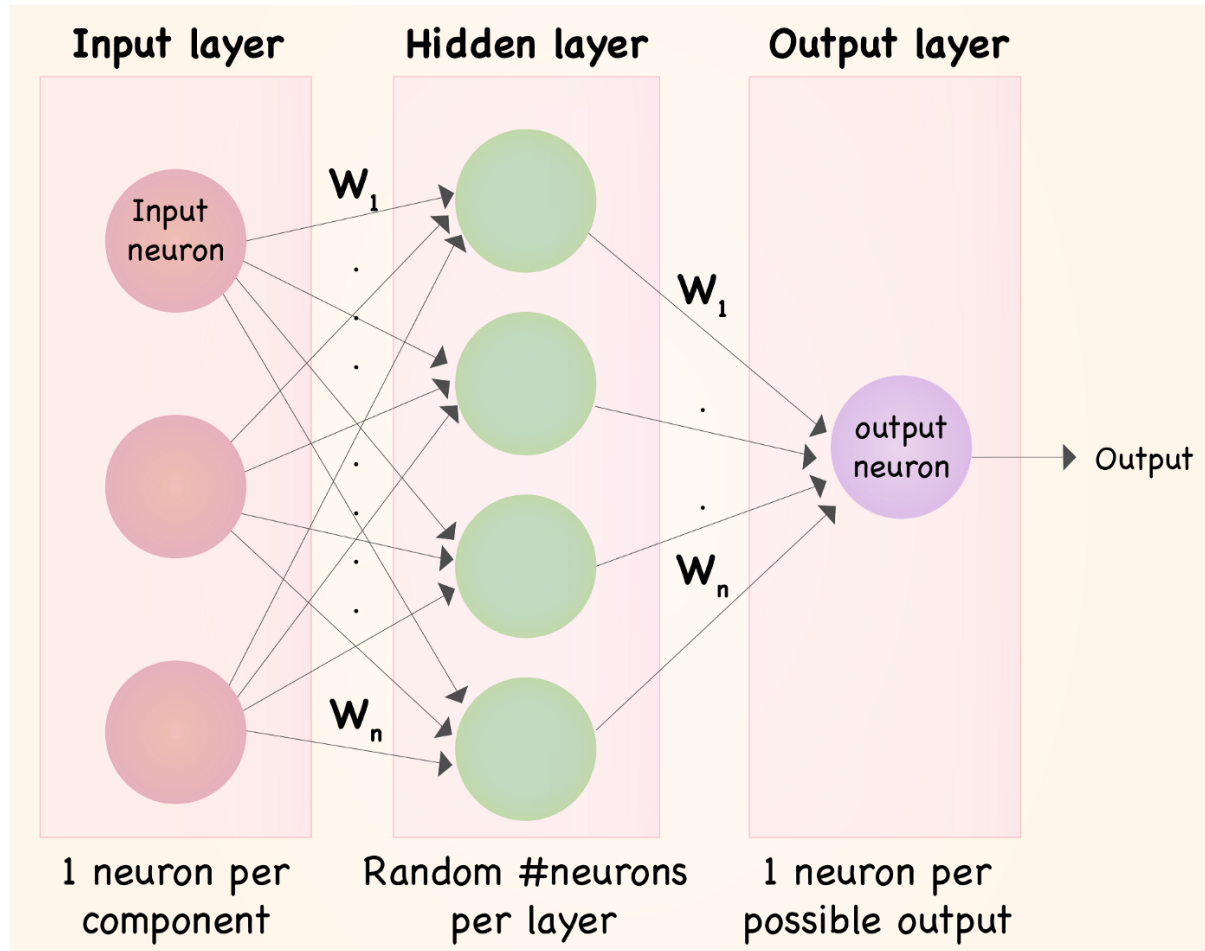


Neural networks -  
SAS

## Neural networks



# How does a neural network look like?

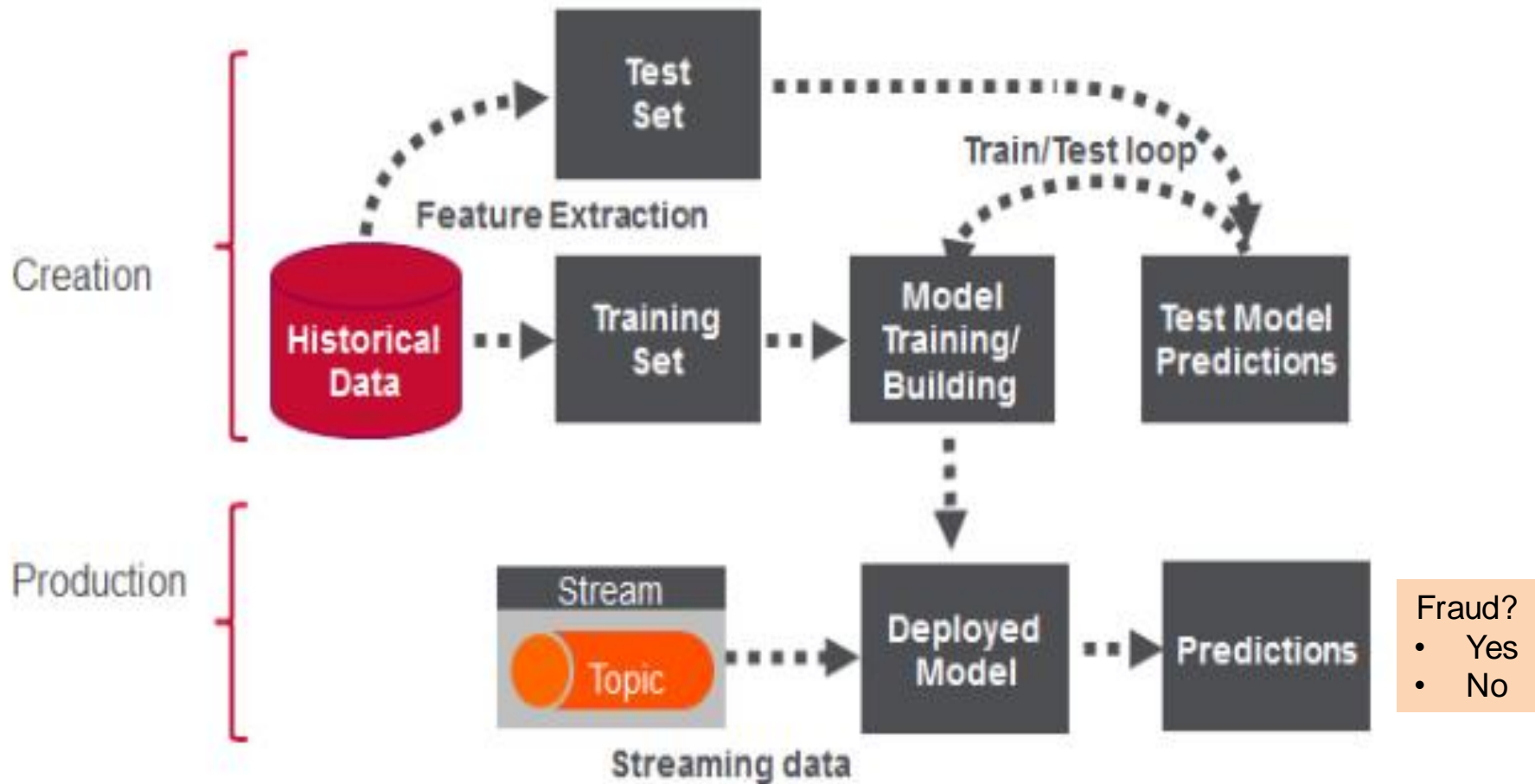


# Steps to build ML model



1. Identify the problem to be solved (how will it benefit the business?)
2. Identify the features: This needs domain knowledge, creativity and lots of time. Ex: If we want to categorize customers, the features used to categorize can be age, salary, product purchased, where purchased, when, etc.
3. Decide on the model: What algorithm to use – supervised, unsupervised, reinforcement?
4. Train-test-validate the model
5. Experiment: Keep improving the model

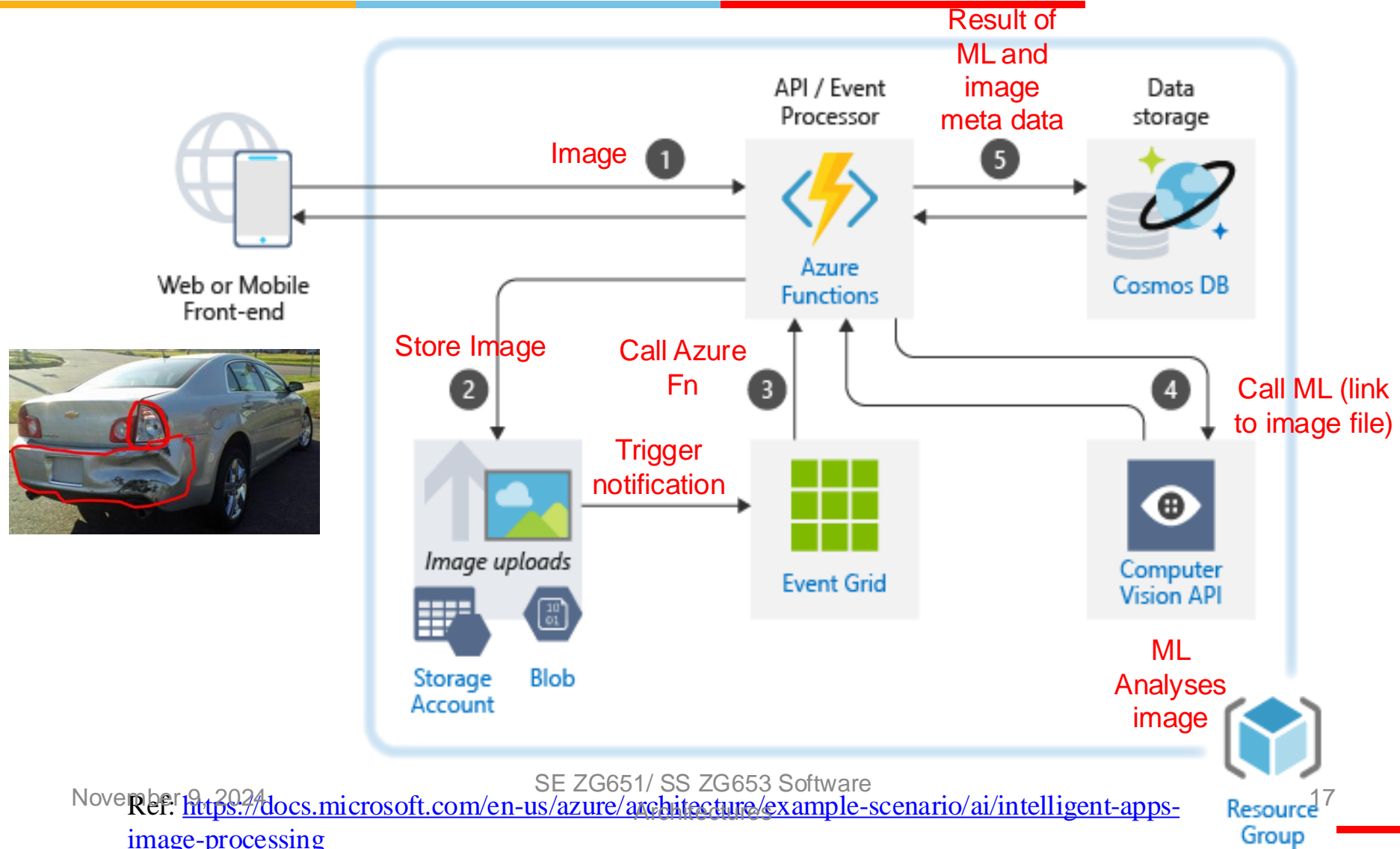
# Building the model: Fraud detection





# Architecture of ML system:

## Image classification for insurance claims



# Popular tools



- Scikit Learn - It provides models and algorithms for Classification, Regression, Clustering, Dimensional reduction, Model selection
- PyTorch – Neural Networks
- Tensor Flow – Neural networks
- Apache Mahout - Regression, Clustering, Recommenders, and Distributed Linear Algebra.
- Spark MLlib –

# Experience sharing

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What problem did you solve using ML?

What steps did you follow to develop the system?

What were the key challenges you faced?

# References



ML primer SAS



Case studies in  
ML



Workflow of ML  
project



6 steps to build a  
ML system

# Thank you

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