Abdelhamid Mehri University - Constantine 2
Fundamental Computer Science and its Applications

Intelligent Techniques for Fighting Fraud and Corruption Code : ITFC

2024-2025

Interest: Data Science, ML, Dl, Medical Imaging, Disease Classification, and Fraud Detection.

Content Table

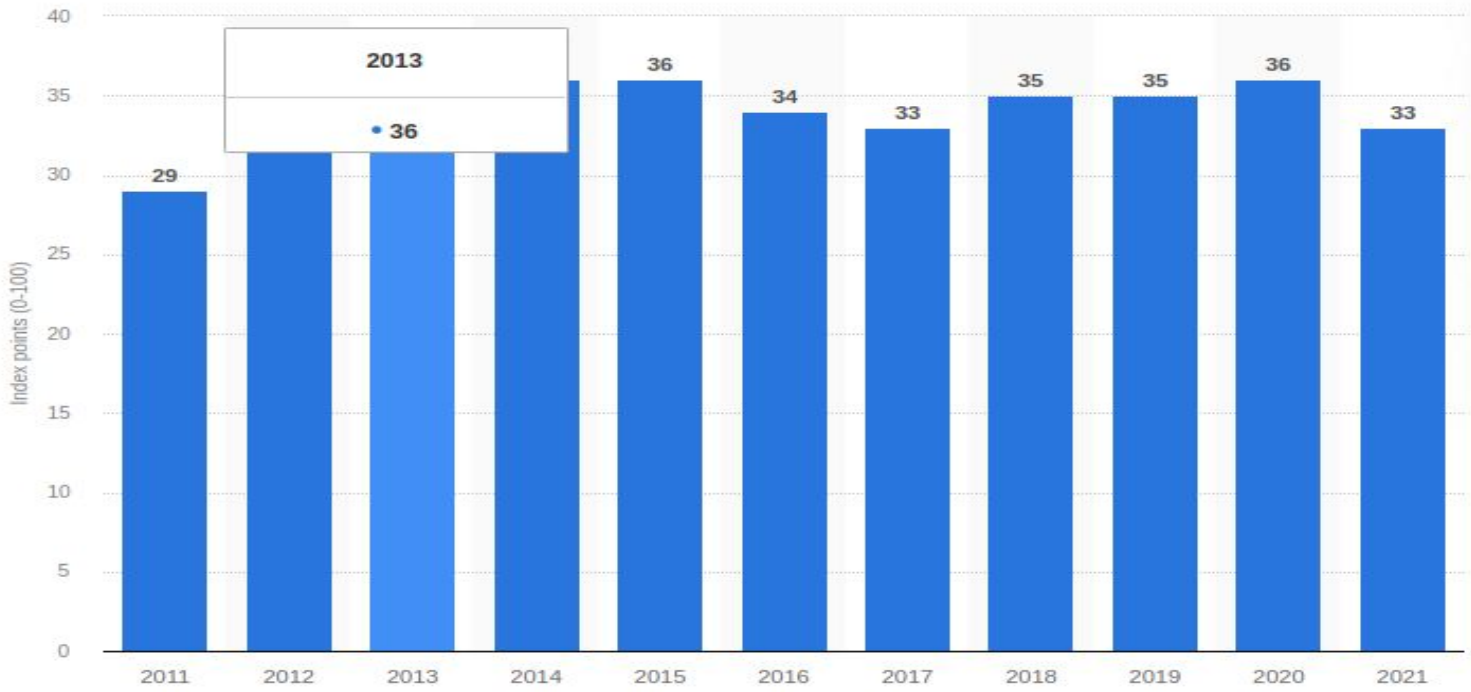
1- Introduction

Corruption

Corruption

Economy & Politics › Economy

Corruption perception index in Algeria from 2011 to 2021



Corruption: Bribery

Algeria jails ex-energy chief Chakib Khelil for 20 years

Khelil, now 82, quit his post in 2010 and moved to the United States after being associated with a scandal involving high-ranking Sonatrach officials later jailed for corruption.

Wednesday 29/06/2022

Corruption: Embezzlement

Corruption: Fraud

To be seen next in Fraud section

Corruption: Nepotism

Let me hear your stories

Corruption: Definition

Corruption is the misuse of power by people in authority for personal benefit. It happens when those in charge make dishonest choices that go against laws or ethical standards.

Corruption Forms

- **Bribery**
- **Embezzlement**
- **Fraud**
- **Nepotism**

Corruption Types

Petty Corruption

Grand Corruption

Systemic Corruption

Fraud

Fraud: Financial Statement Fraud

Fraud: Credit Card Fraud Target Data Breach

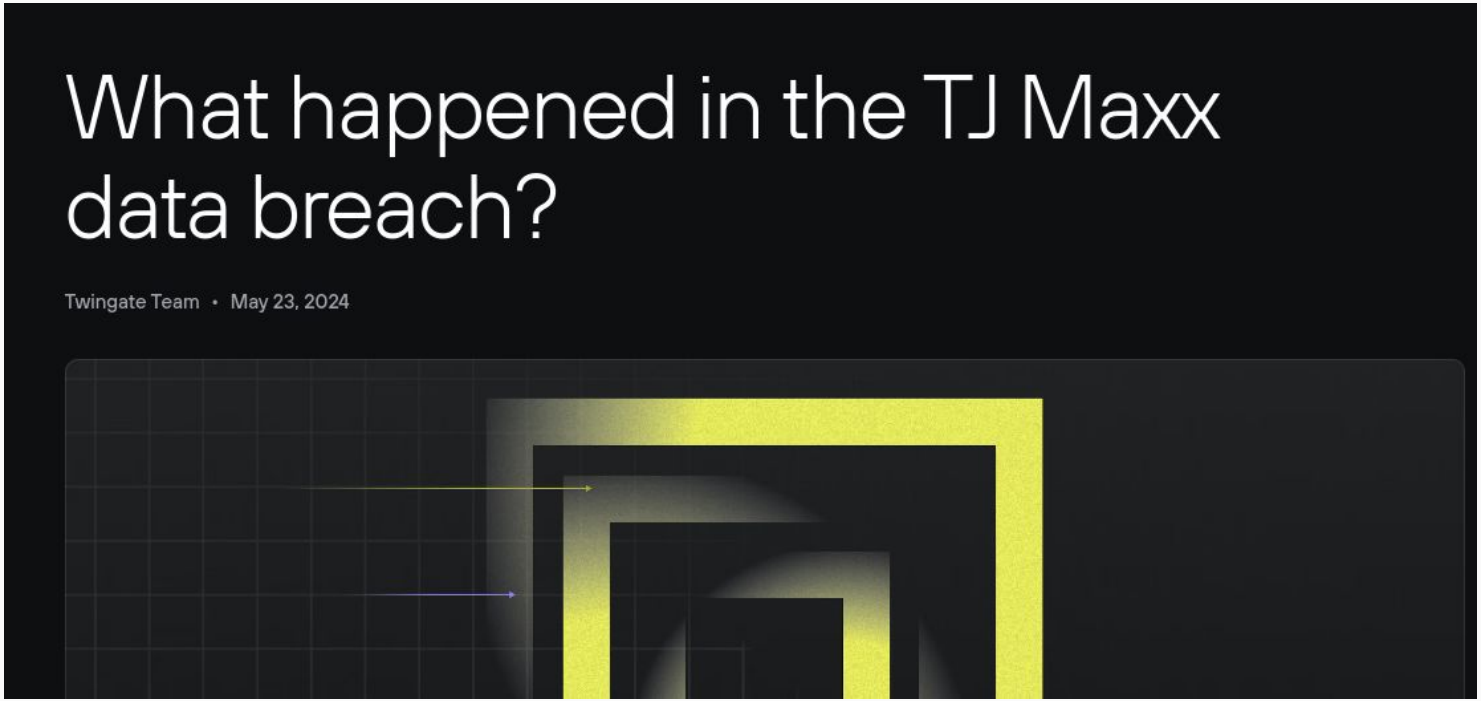
Fraud: Insurance Fraud

Man who faked death back in court

December 23, 2005 — 2.09am

Sydney man Harry Gordon, who faked his own death as part of a life insurance scam, had two main objectives this year.

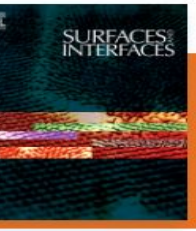
Fraud: Identity Theft



Fraud: Academic Fraud

Top Harvard Medical School Neuroscientist Accused of Research Misconduct

Fraud: Academic Fraud



Surfaces and Interfaces

8.5 CiteScore | 5.7 Impact Factor

ELSEVIER

Surfaces and Interfaces

journal homepage: www.sciencedirect.com/journal/surfaces-and-interfaces

The three-dimensional porous mesh structure of Cu-based metal-organic-framework - aramid cellulose separator enhances the electrochemical performance of lithium metal anode batteries

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ARTICLE INFO

Keywords:
Lithium metal battery
Lithium dendrites
CuMOF-ANFs separator

ABSTRACT

Lithium metal, due to its advantages of high theoretical capacity, low density and low electrochemical reaction potential, is used as a negative electrode material for batteries and brings great potential for the next generation of energy storage systems. However, the production of lithium metal dendrites makes the battery life low and poor safety, so lithium dendrites have been the biggest problem of lithium metal batteries. This study shows that the larger specific surface area and more pore structure of Cu-based metal-organic-framework - aramid cellulose (CuMOF-ANFs) composite separator can help to inhibit the formation of lithium dendrites. After 110 cycles at 1 mA/cm^2, the discharge capacity retention rate of the Li-Cu battery using the CuMOF-ANFs separator is about 96 %. Li-Li batteries can continuously maintain low hysteresis for 2000 h at the same current density. The results show that CuMOF-ANFs composite membrane can inhibit the generation of lithium dendrites and improve the cycle stability and cycle life of the battery. The three-dimensional (3D) porous mesh structure of CuMOF-ANFs separator provides a new perspective for the practical application of lithium metal battery.

RETRACTED

1. Introduction

Certainly, here is a possible introduction for your topic:Lithium-metal batteries are promising candidates for high-energy-density rechargeable batteries due to their low electrode potentials and high theoretical capacities [1,2]. However, during the cycle, dendrites

chemical stability of the separator is equally important as it ensures that the separator remains intact and does not react or degrade in the presence of the electrolyte or other battery components. A chemically stable separator helps to prevent the formation of reactive species that can further promote dendrite growth. Researchers are actively exploring

Fraud: investment fraud and pyramid scheme fraud

Fraud: cyber fraud
Phishing

> From: facebook.shares2014@lottery.com
> Subject: Congratulations your facebook account won
> To: [redacted]
> Date: Mon, 21 Apr 2014 12:53:29 -0400
>
> Ref: 990078567
> Batch: 9056490602/333
> Winning no: FB8701/LPRC
> ticket number: 987061725 07056490902
> serial number: 7541137207
>
>
> CONGRATULATIONS.
>
> This is to inform you once again that You have won the sum of $1,000,000:00 OUR 2014 SWEEPSTAKES (Facebook Inc). This is to promote our users worldwide through this online lottery, Which is fully based on an electronic selection.

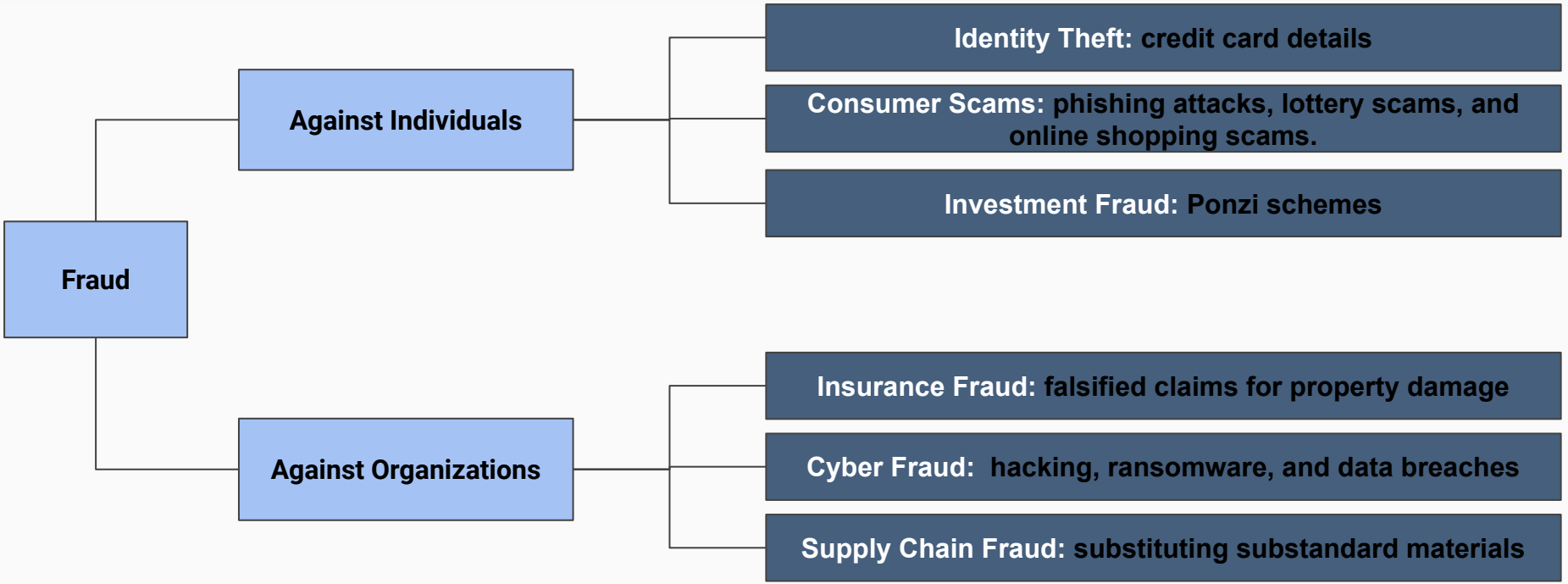
Fraud Definition 8/11

Fraud” is when someone lies or deceives another person to gain something valuable, like money or an advantage. It becomes a crime when it involves knowingly lying about important information to trick someone into making a decision that harms them. This can include making false statements or hiding the truth to mislead others for personal gain

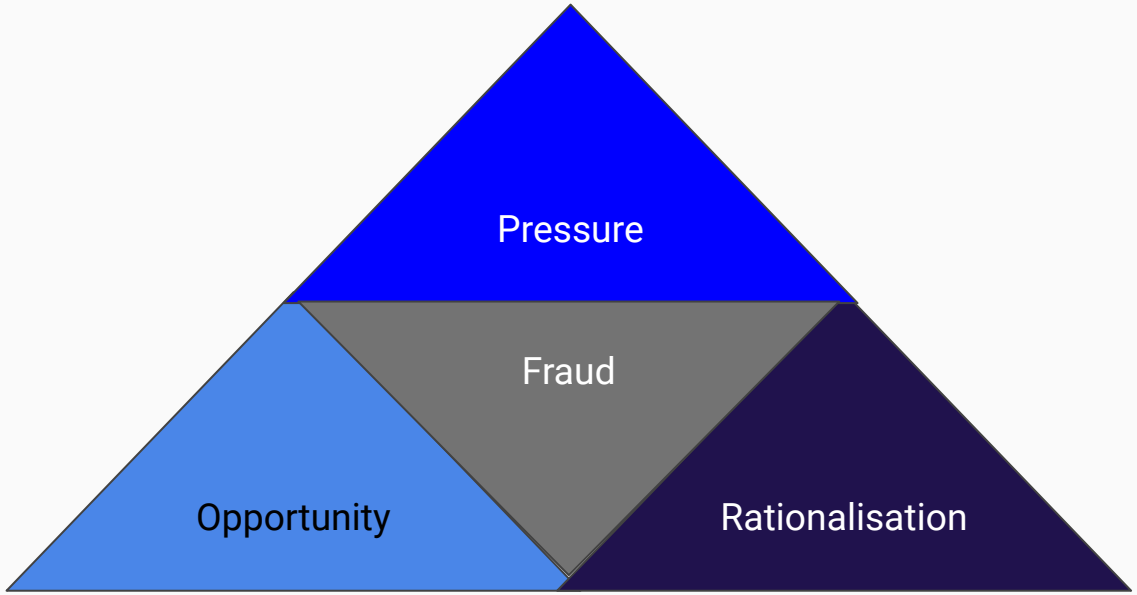
Fraud Types

- **Financial Statement Fraud**
- **Credit Card Fraud**
- **Insurance Fraud**
- **Identity Theft**
- **Academic Fraud**
- **Investment Fraud**

Fraud Classification



Fraud Triangle



Fraud.Vs Corruption

Fraud. vs Corruption

Aspect	Fraud	Corruption
Definition	Independent criminal offense involving deception to gain something of value.	Abuse of power for personal gain, often requiring collusion.
Context of Occurrence	Can occur at an individual level.	Requires collusion with others.
Legal Framework	Specific laws govern fraudulent acts.	Laws focus on organized crime and collusion.
Victim	Typically involves a specific individual or entity.	Victims can include organizations, governments, or society.
Methods of Commission	Involves deceitful practices like lying or misrepresentation.	Involves manipulation of systems, such as bribery.
Common Consequences	Leads to financial loss for individuals or organizations.	Undermines public trust and perpetuates systemic issues.
Interrelation with Other Crimes	Often used as a method to commit other crimes.	Serves as a conduit for organized crime.

Impact of Fraud and Corruption

Impact 1

- Long term psychological impacts for individuals involved, including witnesses, victims and perpetrators .
- Reputational damage and loss of employment for individuals who are found to have committed fraud.
- Reduced morale in business units or causing staff to leave.
- Reduced capacity for government to deliver services and support for Victorian communities.

Impact

- Funding not being available for important public services, such as health and education.
- Resource-intensive and lengthy investigations.
- Reduced public trust in the agency or government more broadly.
- Damage to related industries, security and the environment.

2- Law and Ethics

Legal Frameworks

Understanding Legal Frameworks

- Anti-fraud and anti-corruption laws is a mechanisms protect economic and social stability.
- These laws mitigate corruption's negative impact on growth and public trust.
- Corruption increases investor risk and potential costs (e.g., bribes).
- Diverts public resources to non-essential projects for personal gain.
- Robust legal frameworks create stable environments for equitable growth.

Legal Frameworks: examples 2/7

Legal Frameworks: examples 3/7

RICO

stands for

Racketeer Influenced and Corrupt Organizations Act

Abbreviations.com

Legal Frameworks: Local Laws in Algeria

Type of Corruption	Punishment (Years)	Fine (DZD)
Bribery	2 to 10 years	200,000 to 1,000,000 DZD
Embezzlement	5 to 10 years	500,000 to 2,000,000 DZD
Fraud	3 to 5 years	200,000 to 500,000 DZD

Legal Frameworks: Local Laws in Algeria

Type of Corruption	Punishment (Years)	Fine (DZD)
Abuse of Power	5 to 10 years	500,000 to 2,000,000 DZD
Conflict of Interest	2 to 6 years	100,000 to 500,000 DZD
Money Laundering	10 to 20 years	1,000,000 to 5,000,000 DZD
Tax Evasion	5 to 10 years	500,000 to 2,000,000 DZD
Forgery	3 to 7 years	200,000 to 1,000,000 DZD

Legal Frameworks: Laws in university Plagiarism

Definition	Relevant Article (Excerpt)
Unauthorized use or imitation of another's work without proper attribution, presenting it as one's own.	***Article 3*: "يُعتبر كل استخدام غير مُصرّح به لأعمال الغير سرقة علمية ويخضع للتحقيق من قبل مجلس آداب وأخلاقيات المهنة الجامعية."** ***Article 6*: "يتم النظر في قضايا السرقة العلمية وفق الإجراءات التأديبية المعمول بها داخل المؤسسة."**

Legal Frameworks: Laws in university Cheating

Definition	Relevant Article (Excerpt)
Engaging in dishonest practices during exams, such as using unauthorized materials, copying, or using devices.	***Article 7***: "يُمنع الغش بجميع أشكاله أثناء الامتحانات، ويخضع كل من يُضبط بالغش لإجراءات تحقيق قد تؤدي إلى اتخاذ إجراءات تأديبية." ***Article 10***: "يُعاقب كل من يكرر الغش بإجراءات تأديبية تتناسب مع طبيعة المخالفة."

Legal Frameworks: Laws in university Data Fabrication and Falsification

Definition	Relevant Article (Excerpt)
Altering or fabricating research data or results to misrepresent outcomes.	***Article 4*: "يُعد تزوير البيانات أو تحريف النتائج البحثية مخالفة جسيمة وتُحال الحالات التي يتم ضبطها إلى الجهات المختصة للنظر فيها."** ***Article 9*: "يتم التحقيق في حالات التزوير لاتخاذ الإجراءات المناسبة بناءً على مدى خطورة المخالفة."**

Legal Frameworks: Laws in university Unauthorized Collaboration

Definition	Relevant Article (Excerpt)
Collaborating on assignments meant for individual completion without permission.	***Article 5*: "يُمنع التعاون غير المصرّح به بين الطلاب في الأعمال الأكاديمية الفردية، ويتم التعامل مع المخالفات من خلال مجلس آداب وأخلاقيات المهنة الجامعية."** ***Article 8*: "تُتخذ الإجراءات التأديبية بناءً على حجم المخالفة وتكرارها."**

Ethical Considerations

Ethics: **Scenario**

Scenario: A student discovers that a classmate is cheating on an exam. They have to decide whether to report the cheating or stay silent.

Explore themes of integrity, honesty, and the potential consequences of both actions.

Ethics: **Scenario 2/6**

A group of university students is assigned a collaborative project. One member, Sara, struggles to contribute due to personal issues and time constraints. As the deadline approaches, Sara copies sections from a well-written paper found online and submits it as part of the group's work, thinking no one will notice.

Ethics: Definiton

Ethics is a set of moral principles and rules that define right and wrong conduct. Derived from the Latin word "ethos," meaning character, ethics encompasses the study of concepts such as good and bad behavior, moral and immoral actions, and the fundamental principles of decent human conduct. It reflects beliefs about justice and fairness and guides individuals and organizations in their interactions and obligations to society.

Ethics Examples

Using Influence for Personal Gain
Interest-Based Financial Transactions
Gambling

Laws vs Ethics

Laws vs Ethics

Aspect	Ethics	Laws
Nature	Based on moral principles and personal beliefs, subjective and varying across cultures	Formal rules established by authorities, objective and apply universally within a jurisdiction
Purpose:	Guides individuals on right and wrong, encouraging integrity and fairness	Maintains order and protects citizens, setting minimum standards of behavior
Enforcement	Self-regulated or enforced by professional organizations; consequences are usually non-legal	Enforced by government agencies, police, and courts; violations lead to legal penalties

Laws vs Ethics

Aspect	Ethics	Laws
Flexibility	Flexible and adaptable to different contexts; can evolve with changing societal values.	More rigid and defined; changes require formal legislative action and tend to be slower.
Example	Unethical to lie (e.g., dishonesty in relationships), though not illegal	Illegal to commit fraud, which is punishable by fines or imprisonment

3- Detecting Corruption and Fraud with Artificial Intelligence

AI: Overview

AI: Definition

AI

Artificial Intelligence (AI) is a branch of computer science focused on creating systems capable of performing tasks that typically require human intelligence. These tasks include decision-making, problem-solving, language understanding, and sensory perception. AI has gained prominence across a wide range of fields, including fraud detection and corruption classification, where large datasets and complex patterns necessitate advanced analytical tools.

AI: Definition

Key Components of AI:

- **Learning:** AI systems have the capacity to improve their performance by processing large amounts of data, often through machine learning techniques.
- **Reasoning:** AI systems can apply logic and rules to make decisions or predictions based on available data.
- **Self-Correction:** These systems refine their accuracy and adjust strategies based on feedback and results.
- **Perception:** AI includes capabilities such as computer vision and natural language processing, allowing it to "perceive" its environment through sensory data.

Data science

Data science can be defined as an interdisciplinary field that combines methods from statistics, computer science, and domain knowledge to extract meaningful insights and knowledge from structured and unstructured data. It involves the use of techniques for data collection, data preprocessing, analysis, machine learning, and visualization to interpret data and inform decision-making. Data science emphasizes the application of algorithms, models, and systems to solve real-world problems by leveraging large amounts of data.

This field includes elements such as:

- **Statistics and Probability**: For understanding patterns and making inferences from data.
- **Machine Learning**: For building predictive models and automating decision-making processes.
- **Data Engineering**: For managing and organizing large datasets.
- **Data Visualization**: For interpreting and communicating findings through graphs and visualizations.
- **Ethics**: For considering the impact of data usage and analysis on privacy, fairness, and bias

Data science vs.AI

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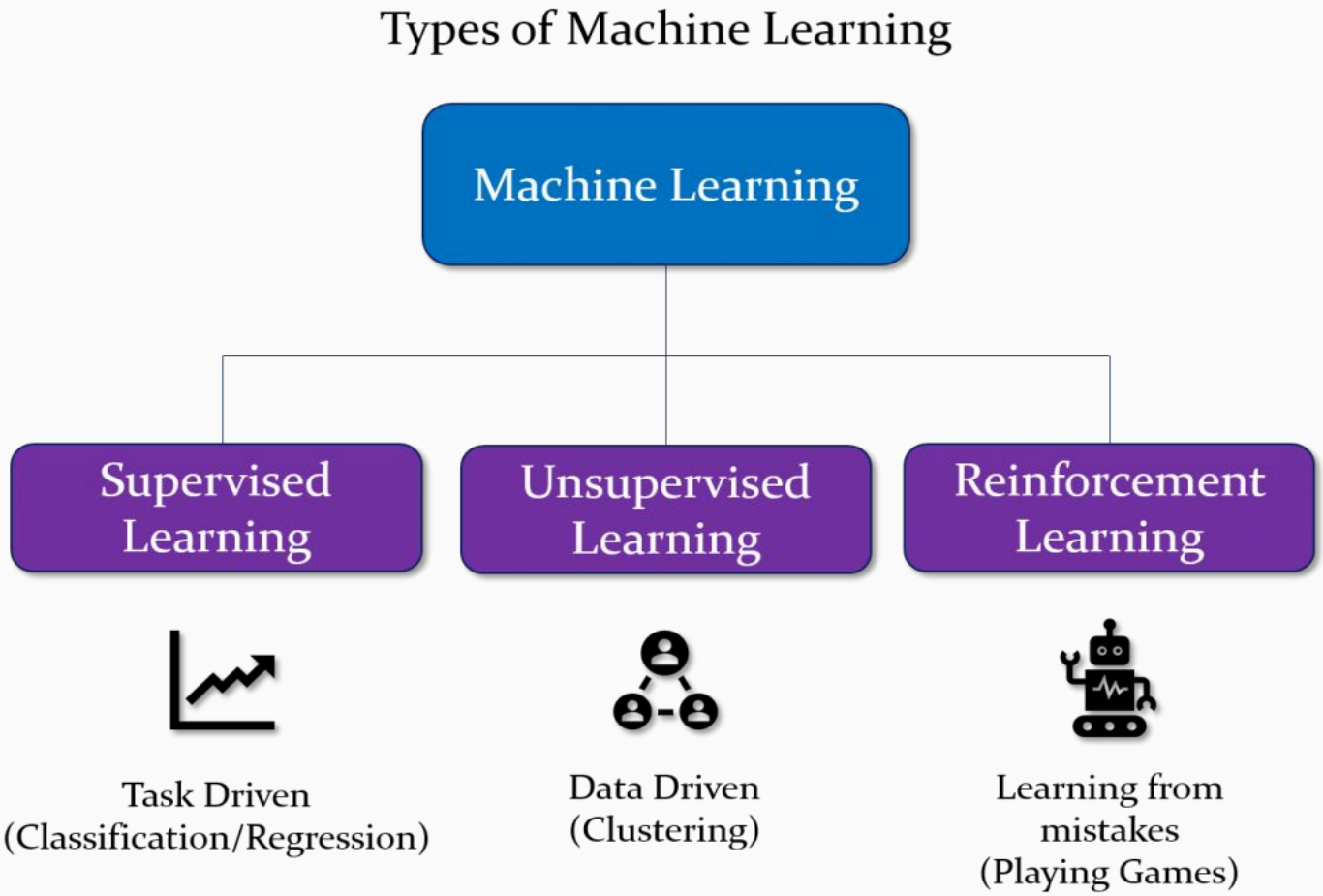
Machine Learning: Definition

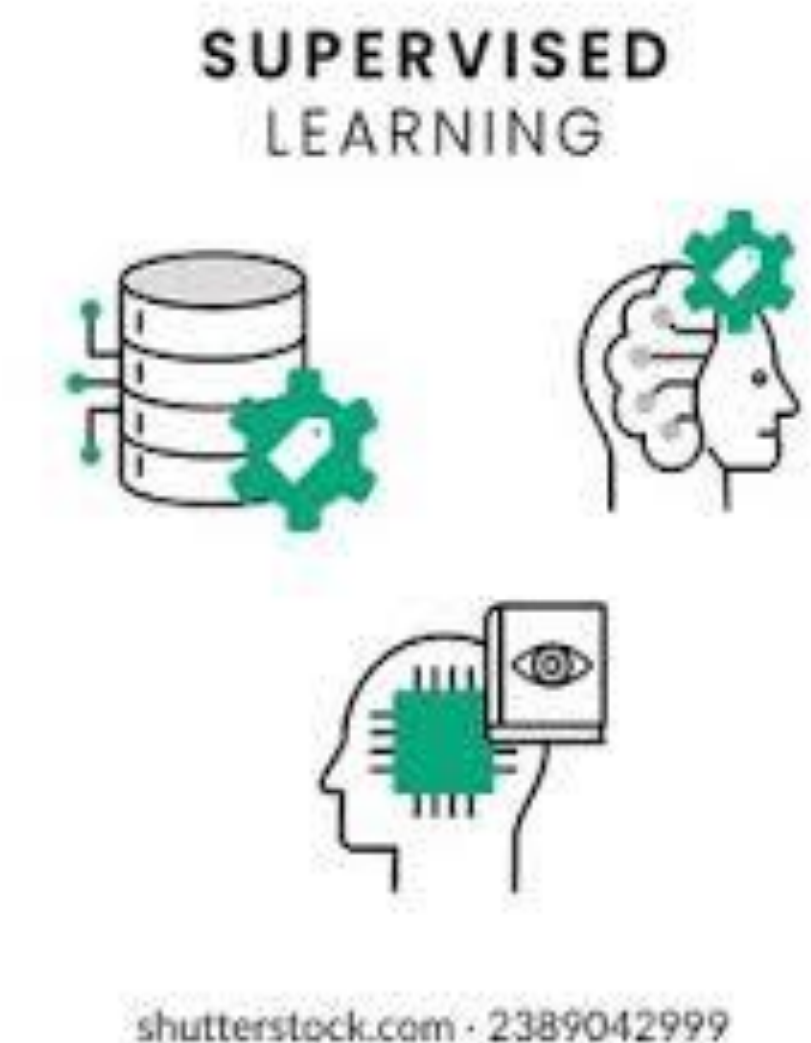
Key Components of AI

ML, a subfield of AI, focuses on the development of algorithms that allow machines to learn from and make predictions based on data.

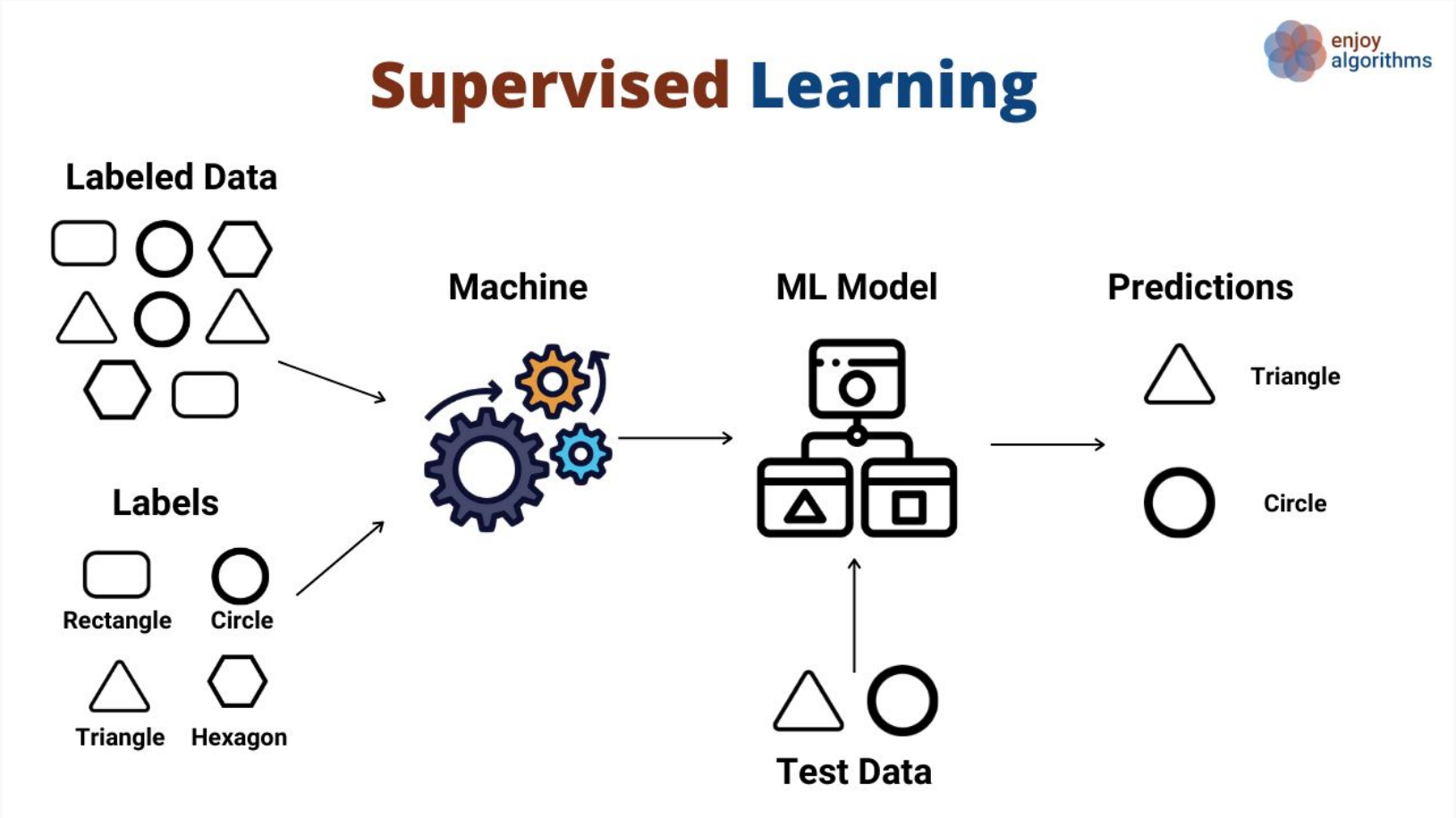
Machine Learning: Types 8/



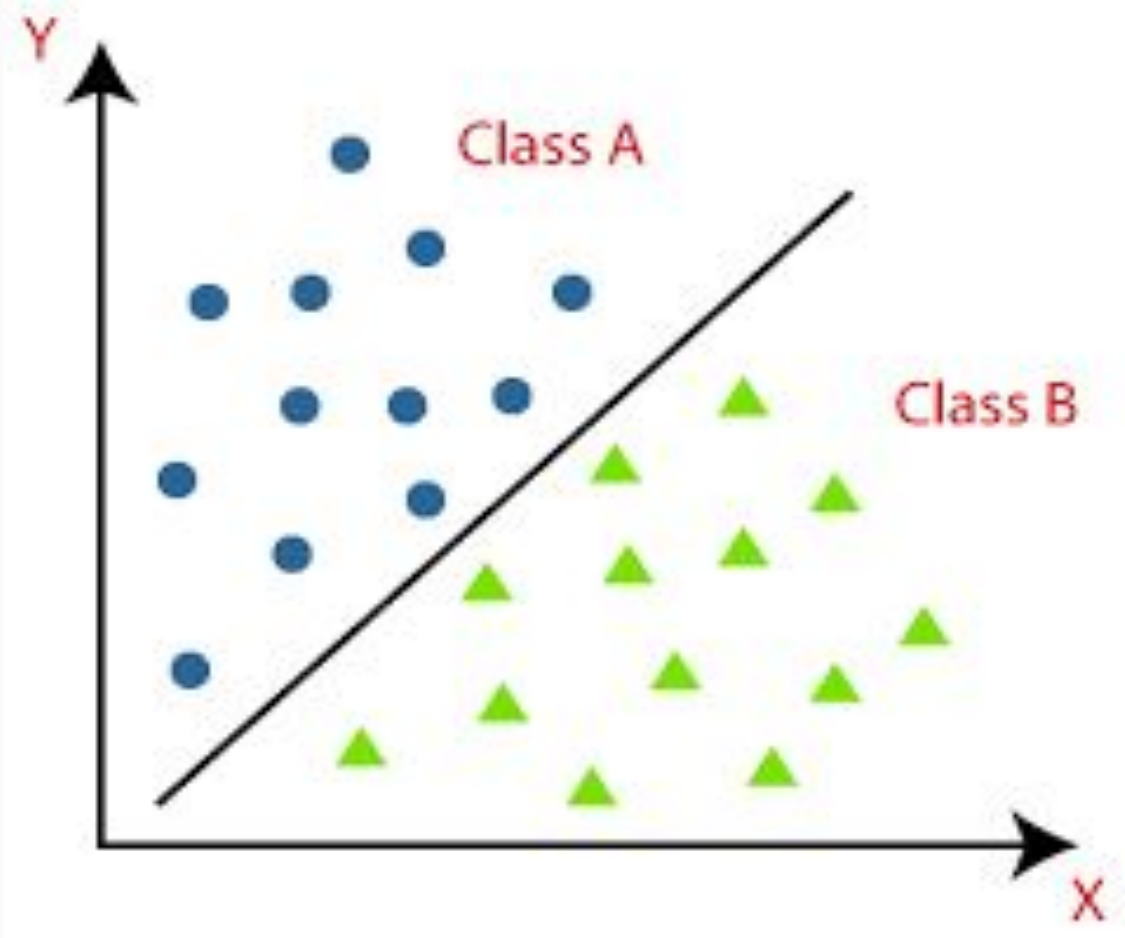
Supervised ML



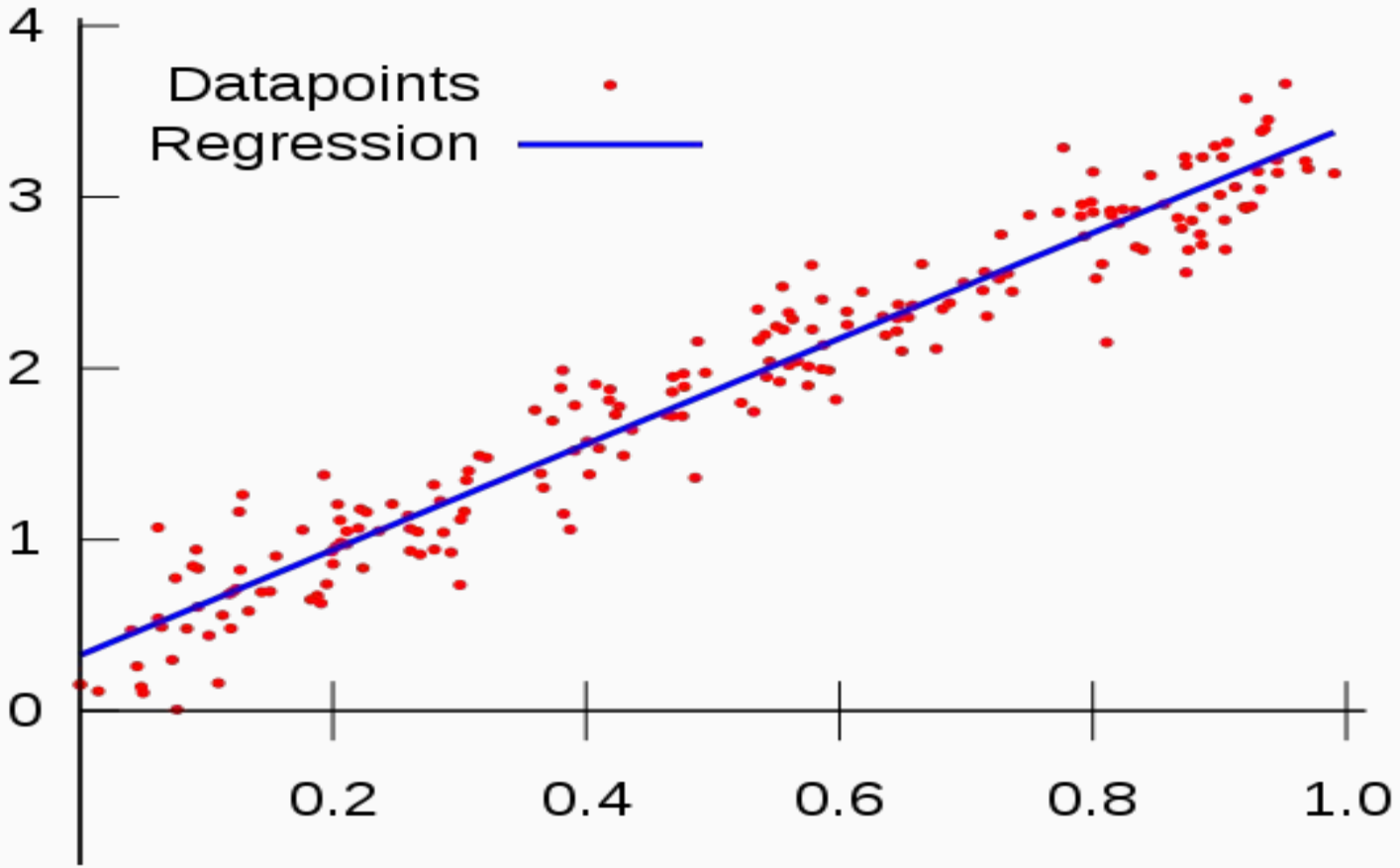
Machine Learning: Supervised Learning 1/



Supervised Learning: Classification 2/



Supervised Learning: Regression 4/



Classification vs.Regression

Aspect	Classification	Regression
Definition	**Predicts categorical outcomes (labels/classes).**	**Predicts continuous outcomes (numerical values).**
output	**Discrete labels (e.g., yes/no, class A/class B).**	**Continuous values (e.g., prices, temperatures).**
Use Cases	**Fraud detection, spam detection, sentiment analysis.**	**Stock price prediction, sales forecasting, risk assessment.**
Types	**Binary, multi-class, multi-label classification.**	**Linear regression, polynomial regression, multiple regression, etc.**

Classification vs Regression

Aspect	Classification	Regression
Nature of Relationship	**Models the relationship between input features and class labels.**	**Models the relationship between input features and a continuous output variable.**
Output Interpretation	**Predicted class label; probabilities for each class in multi-class scenarios.**	**Predicted value; can include confidence intervals for the predictions.**
Data Characteristics	**Can work well with imbalanced datasets (e.g., rare events).**	**Assumes a linear or functional relationship between variables; sensitive to outliers.**
Common Challenges	**Imbalanced classes, overfitting, need for interpretability.**	**Assumptions of linearity, multicollinearity, overfitting, and outliers.**

Workflow: Classification vs Regression

Step	Classification Workflow	Regression Workflow
1. Problem Definition	Define the classification problem and target labels.	Define the regression problem and target variable.
2. Data Collection	Gather labeled data with class labels (e.g., fraudulent, non-fraudulent).	Gather labeled data with continuous target values (e.g., transaction amounts)
3.Data Preprocessing	- Handle missing data. - Encode categorical variables. - Balance classes if imbalanced. - Normalize/standardize features.	- Handle missing data. - Normalize/standardize features. - Identify and handle outliers.
4. Feature Selection and Engineering	Select relevant features that contribute to the classification task. Engineer new features if needed.	Select relevant features for predicting the target variable. Engineer new features if needed.

Classification vs Regression

Step	Classification Workflow	Regression Workflow
5. Splitting the Data	**Split the data into training and testing sets (e.g., 80/20).**	**Split the data into training and testing sets (e.g., 80/20).**
6. Choosing a Model	**Select appropriate classification algorithms (e.g., Logistic Regression, Decision Trees).**	**Select appropriate regression algorithms (e.g., Linear Regression, Polynomial Regression).**
7. Model Training	**Train the model on the training data to classify inputs.**	**Train the model on the training data to predict continuous outcomes.**
8. Model Evaluation	**accuracy, precision, recall, F1-score, and ROC-AUC.**	**Mean Absolute Error (MAE), Mean Squared Error (MSE), and R-squared (R^2).**

Classification WorkFlow for Fraud Detection

1. Problem Definition

- **Description**: Clearly define the classification problem, including the objective and the target labels.
- **Example**: For fraud detection, the problem might be defined as: “Classify whether a given transaction is fraudulent or legitimate based on transaction features.”

Classification WorkFlow for Fraud Detection 9/

2. Data Collection:

Identify and Source Data

Label the Data

Extract and Engineer Relevant Features

Classification WorkFlow for Fraud Detection

1. Data Collection:

Use Appropriate Data Collection Techniques:

- **APIs**: Gather data programmatically from external sources.
- **Web Scraping**: Extract data from websites (with ethical and legal considerations).
- **Sensor Data**: Capture real-time data, especially in IoT-based applications.
- **Manual Collection**: For specific cases where automated data collection isn't feasible.

Ensure Compliance and Permissions:
Verify data use permissions and follow privacy laws, particularly for sensitive data like financial or medical records.

Classification WorkFlow for Fraud Detection 9/

3. Data Preprocessing

Data preprocessing is crucial for enhancing model accuracy and reliability. In this step:

3.1 Handle Missing Data:

3.2 Encode Categorical Variables

3.3 Normalize/Standardize Features

3.4 Balance Classes:

Classification WorkFlow for Fraud Detection 9/

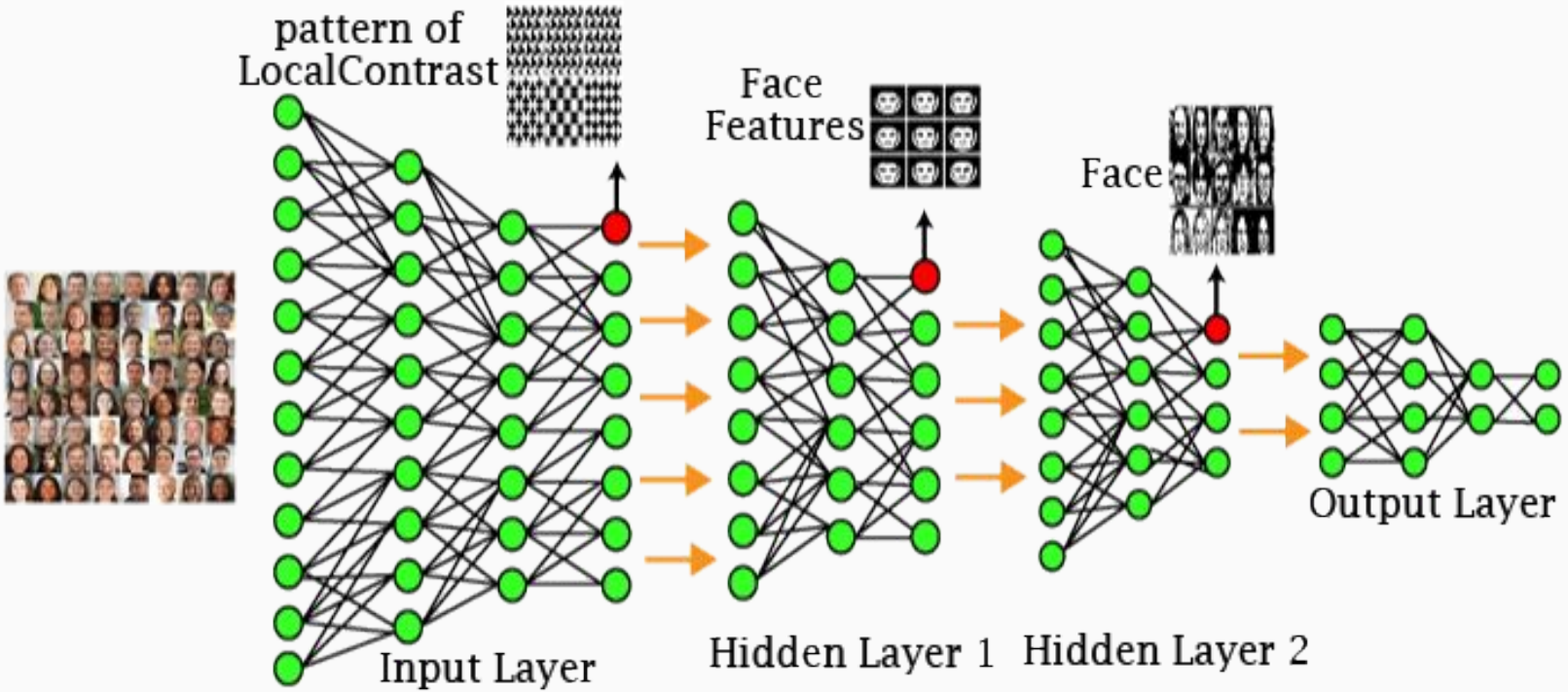
4 Classification Based Deep Learning Models

Definition

- Deep learning is the subset of machine learning which is based on artificial neural network architecture.
- An artificial neural network uses layers of interconnected nodes called neurons that work together to process and learn from the input data.
- In a fully connected Deep neural network, there is an input layer and one or more hidden layers connected one after the other.
- Each neuron receives input from the previous layer neurons or the input layer.
- The output of one neuron becomes the input to other neurons in the next layer of the network, and this process continues until the final layer produces the output of the network.
- The layers of the neural network transform the input data through a series of nonlinear transformations, allowing the network to learn complex representations of the input data.

Classification WorkFlow for Fraud Detection 9/

4 Classification: Example of Deep Learning



Classification WorkFlow for Fraud Detection 9/

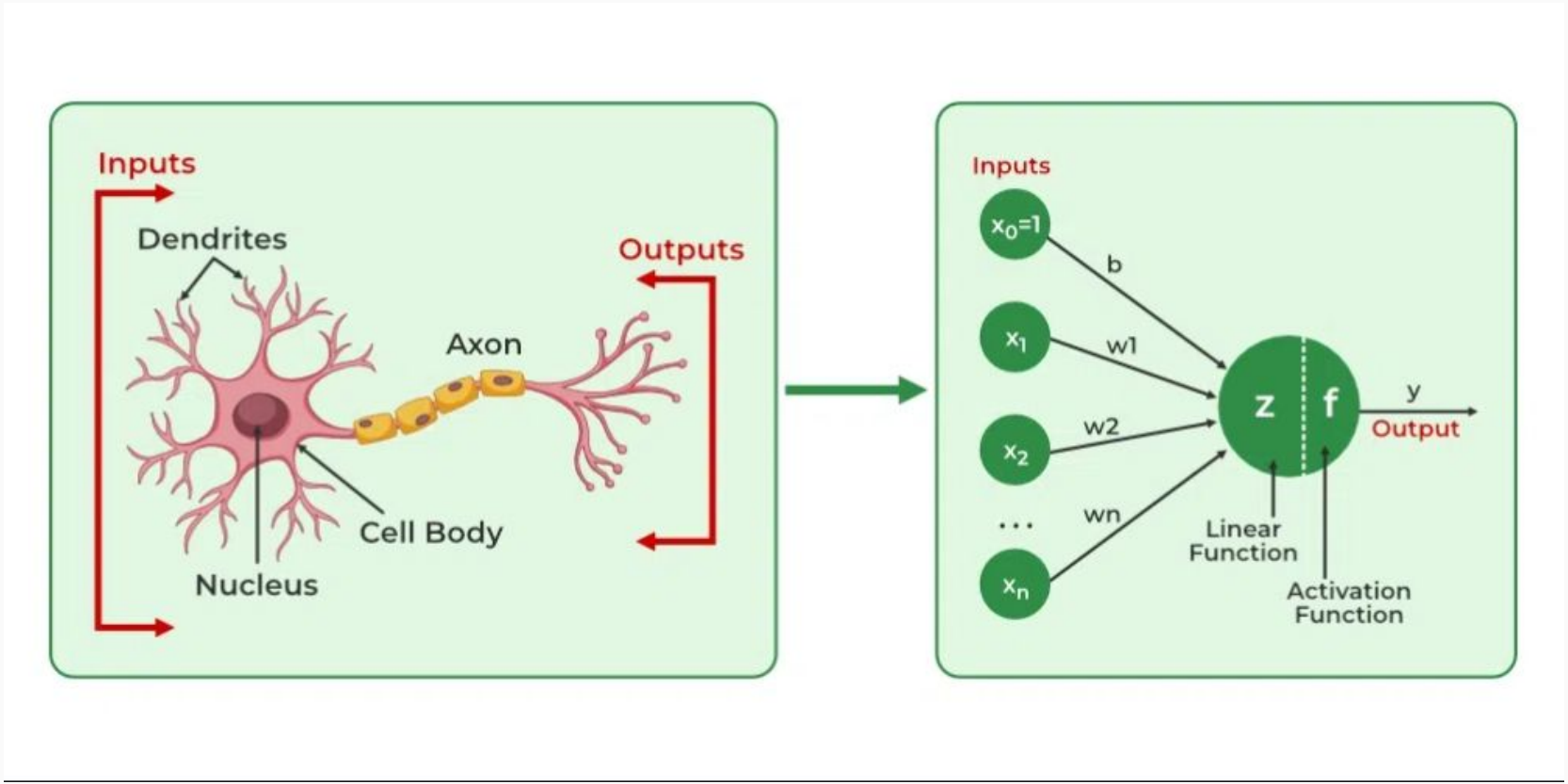
4 Classification: Artificial Neural Network

An **artificial neural network (ANN)** is a computational model inspired by the structure and function of the human brain. It is a type of machine learning model that consists of layers of interconnected nodes, or "neurons," which work together to process input data, learn patterns, and make predictions.

Artificial neural networks are the foundation of deep learning, a branch of machine learning that deals with complex, multi-layered networks used to solve sophisticated tasks, such as image recognition, natural language processing, and more.

Classification WorkFlow for Fraud Detection 9/

4 Classification: Artificial Neural Network



Classification WorkFlow for Fraud Detection 9/

Artificial Neural Network: Key Concepts of Artificial Neural Networks

1. **Neurons (Nodes)**

- Neurons are the basic units of an ANN, similar to biological neurons in the brain.
- Each neuron takes inputs, processes them by applying weights and a bias, and passes the result through an activation function to determine the output.
- The output from one neuron becomes the input for neurons in the next layer.

Why Neurons are Important in ANNs

- **Building Blocks of the Network**
- **Learning Through Weights**
- **Non-Linearity and Complexity**

Classification WorkFlow for Fraud Detection 9/

Artificial Neural Network: Key Concepts of Artificial Neural Networks

1. Neurons (Nodes): Input

1 For Image Data

- The input to the first layer represents **pixel values** from the image.

2. For Tabular Data

- In tabular or structured data, such as data in a spreadsheet or database, each **column represents a feature** of the data.

3. For Text Data

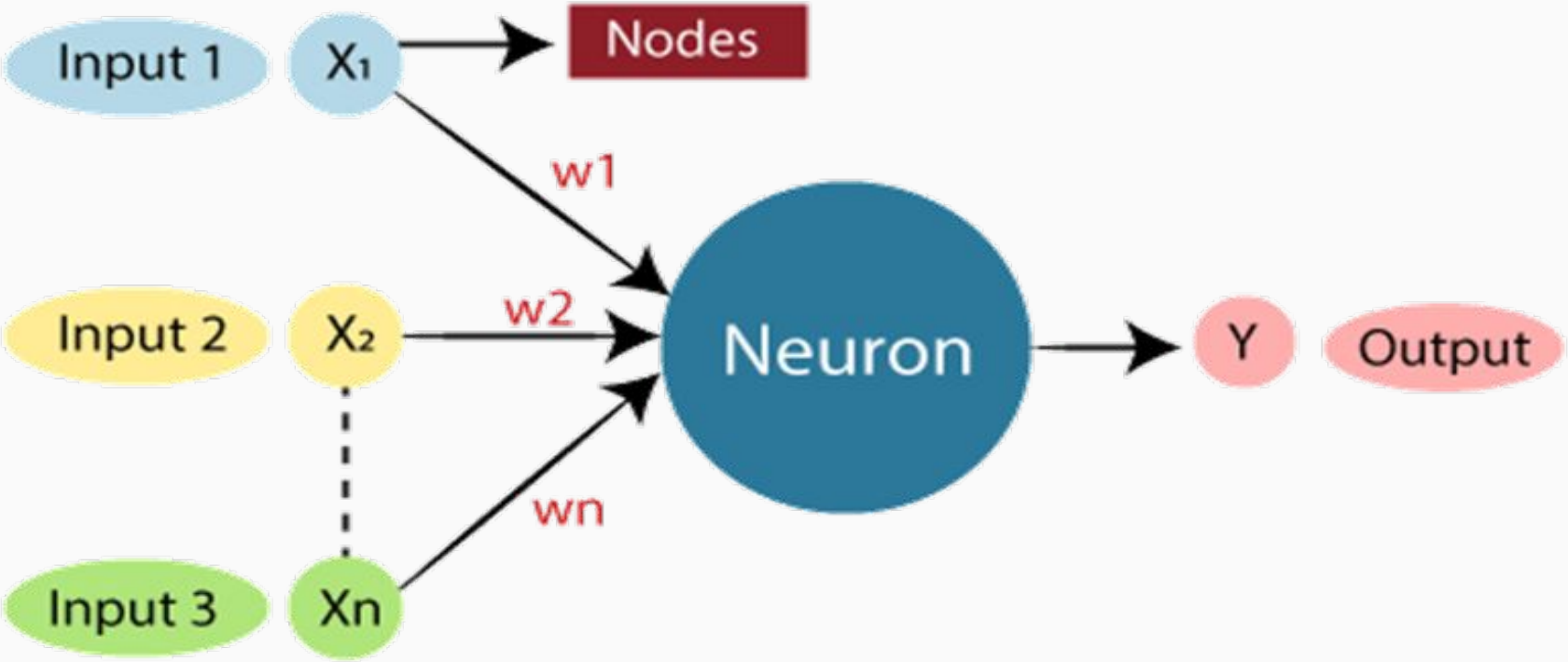
- In text data, the inputs are often numerical representations of words or sentences.

4. For Time-Series Data

- In time-series data, the inputs represent measurements or values recorded over time.

Classification WorkFlow for Fraud Detection 9/

Key Concepts of Artificial Neural Networks: **Neurons (Nodes)**



Classification WorkFlow for Fraud Detection 9/

Key Concepts of Artificial Neural Networks

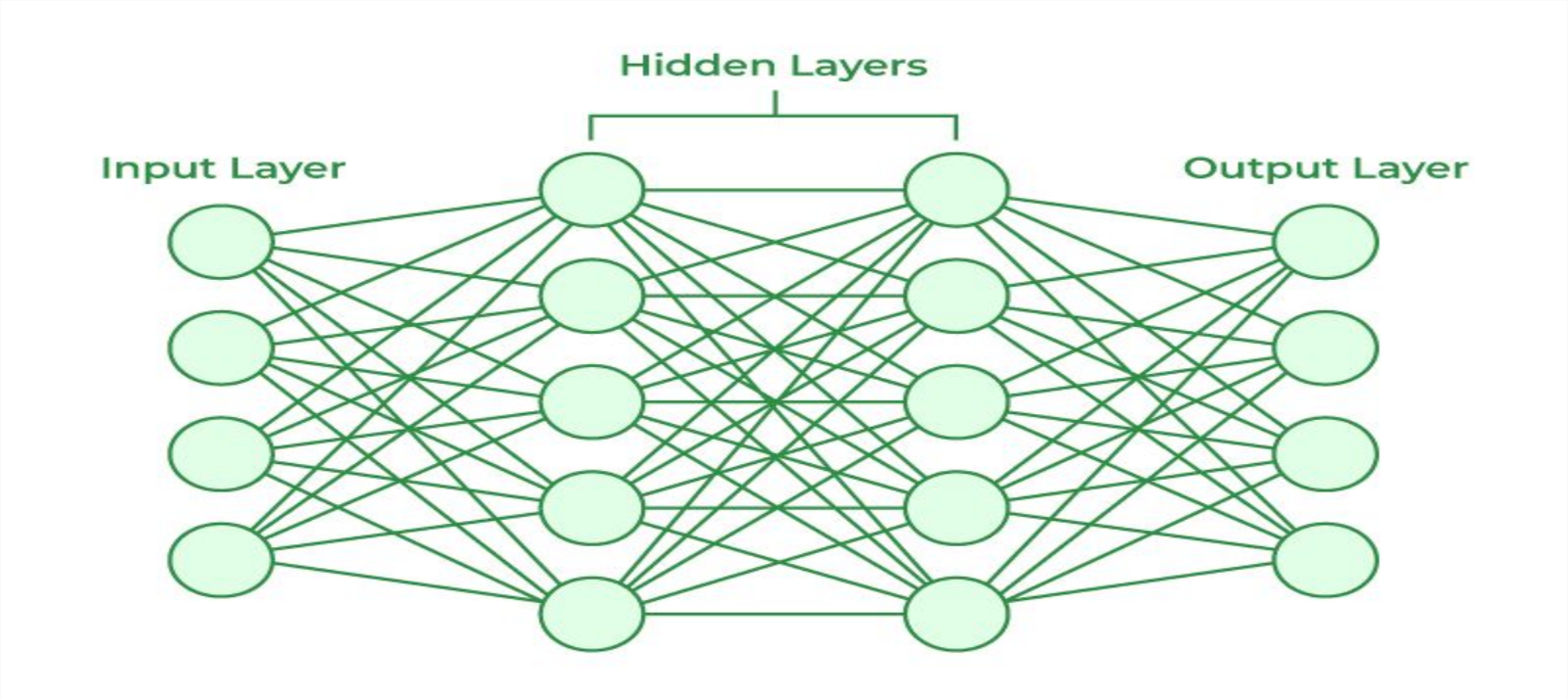
2. Layer

- ANNs are organized into layers:
    - **Input Layer**: The first layer receives raw data directly. Each neuron in this layer represents one feature of the input data (e.g., pixels in an image, features in a dataset).
    - **Hidden Layers**: These are intermediate layers between the input and output. They perform computations on inputs, learn features, and create abstractions through weights and biases. Complex ANNs have many hidden layers, which is why they are referred to as "deep" neural networks.
    - **Output Layer**: The final layer produces the network's prediction. The output can represent different things depending on the task (e.g., probabilities for classification, real values for regression).

Classification WorkFlow for Fraud Detection 9/

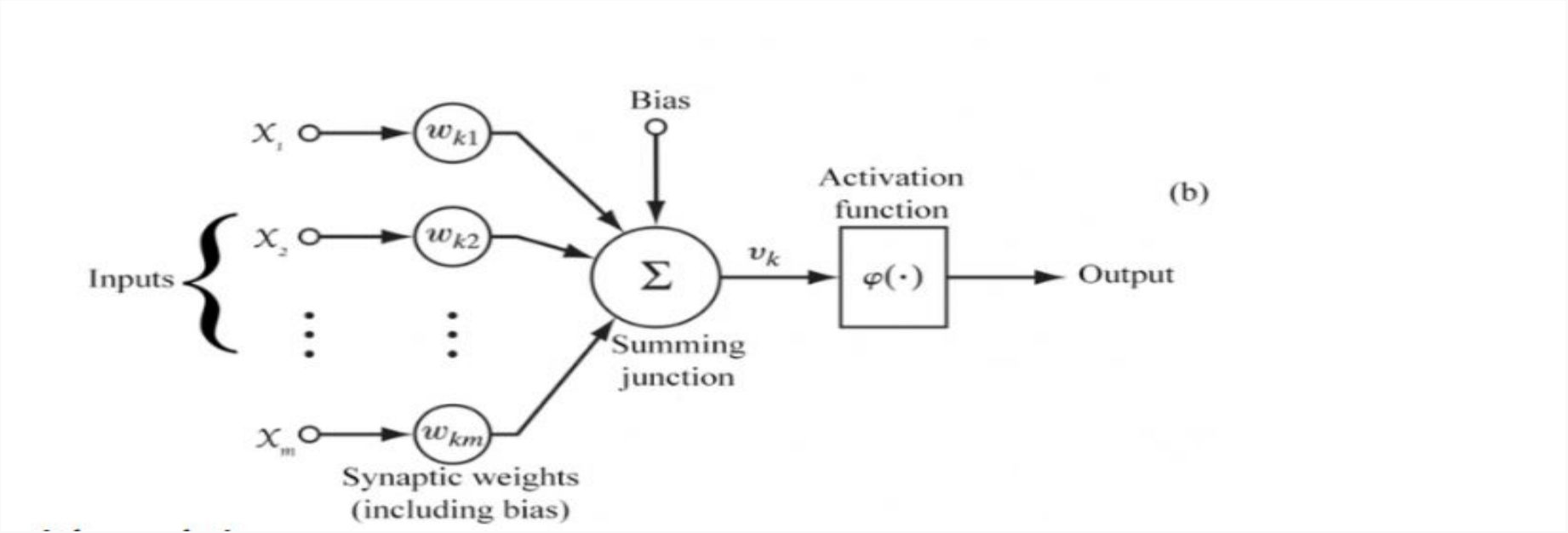
Key Concepts of Artificial Neural Networks

2. Layer

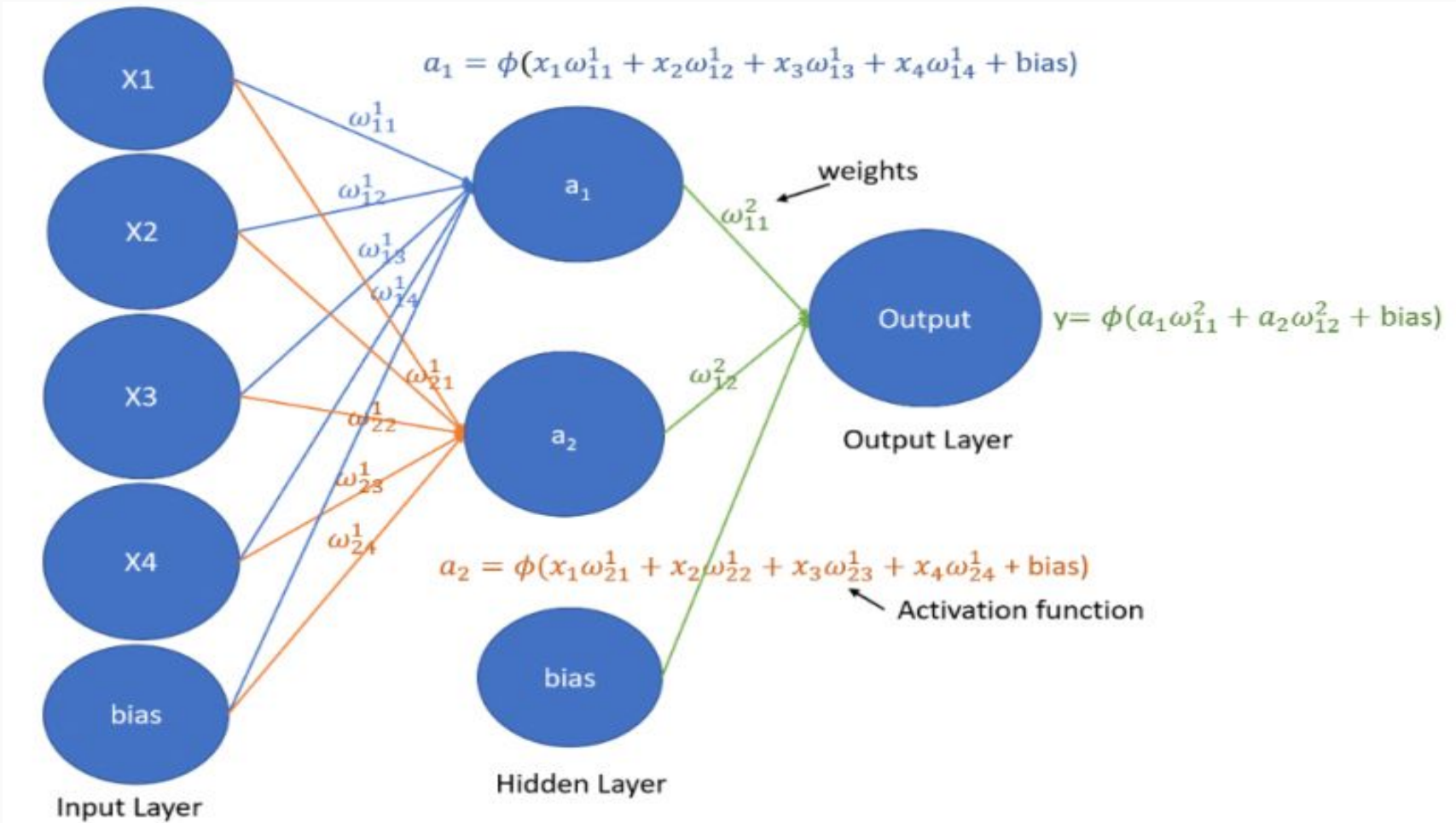


Classification WorkFlow for Fraud Detection

Weights and Biases



Classification WorkFlow for Fraud Detection



Classification WorkFlow for Fraud Detection 9/

Key Concepts of Artificial Neural Networks:

Activation Functions

Activation functions introduce non-linearity into the network, enabling it to model complex patterns.

Common activation functions include:

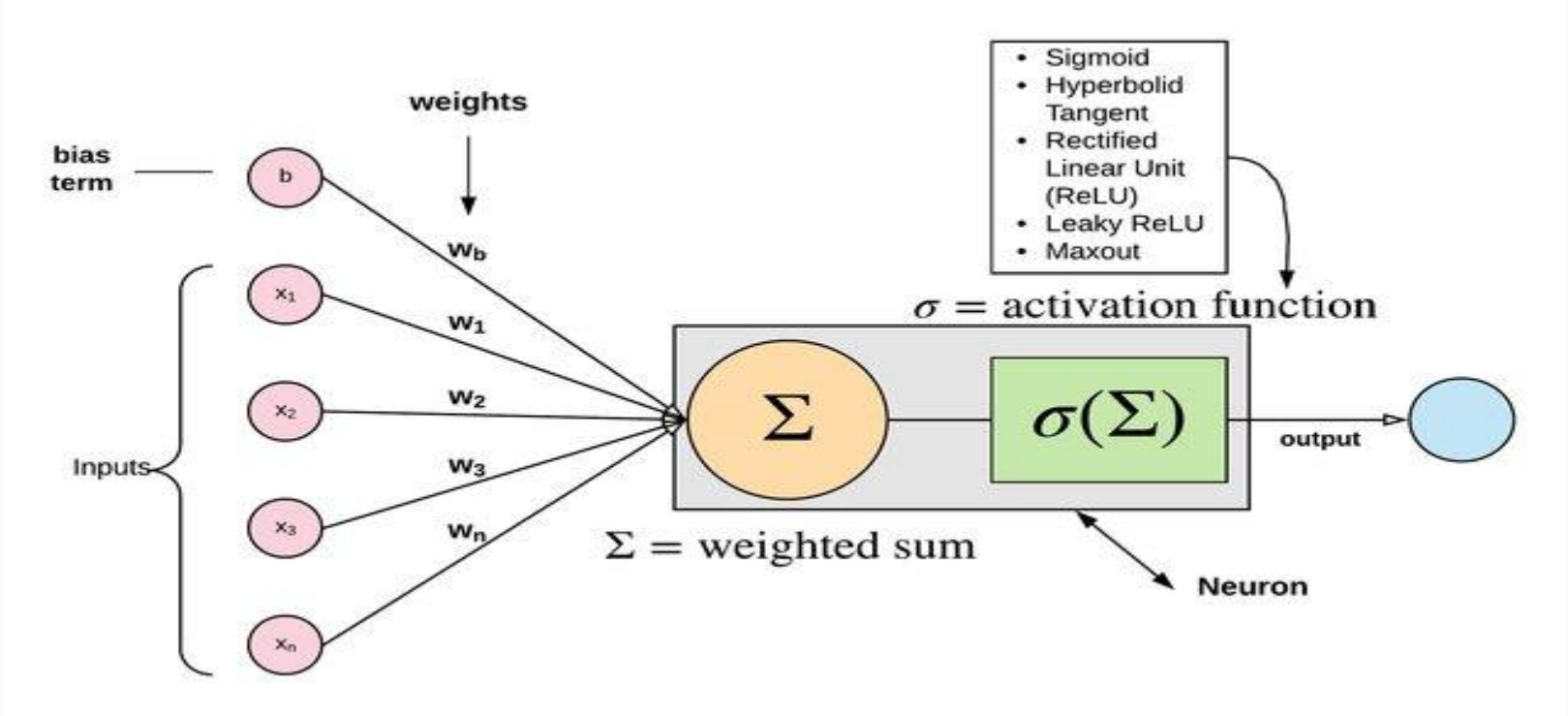
- **sigmoid**,
- **ReLU (Rectified Linear Unit)**,
- **tanh**.

By applying an activation function, a neuron decides whether it should "activate" or "fire" (send its output to the next layer).

Classification WorkFlow for Fraud Detection 9/

Key Concepts of Artificial Neural Networks

3. Activation Functions



Classification WorkFlow for Fraud Detection 9/

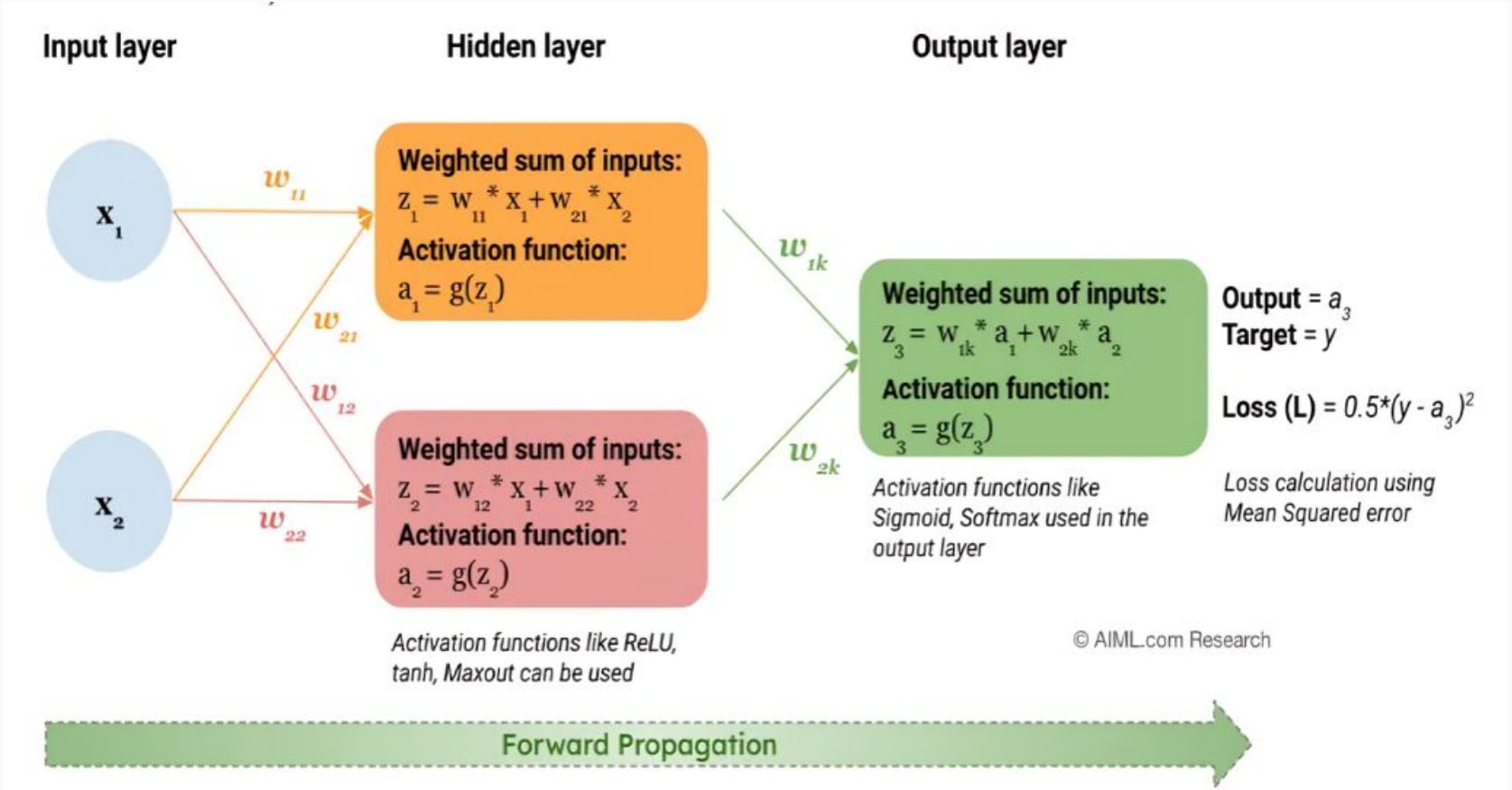
Key Concepts of Artificial Neural Networks:

4 Forward Propagation

- During **forward propagation**, data is passed through the network layer by layer, with each neuron performing its computations, to produce an output.
- The input data is transformed as it moves through each layer, and the final result is generated in the output layer.

Classification WorkFlow for Fraud Detection 9/

Key Concepts of Artificial Neural Networks: **Forward Propagation**



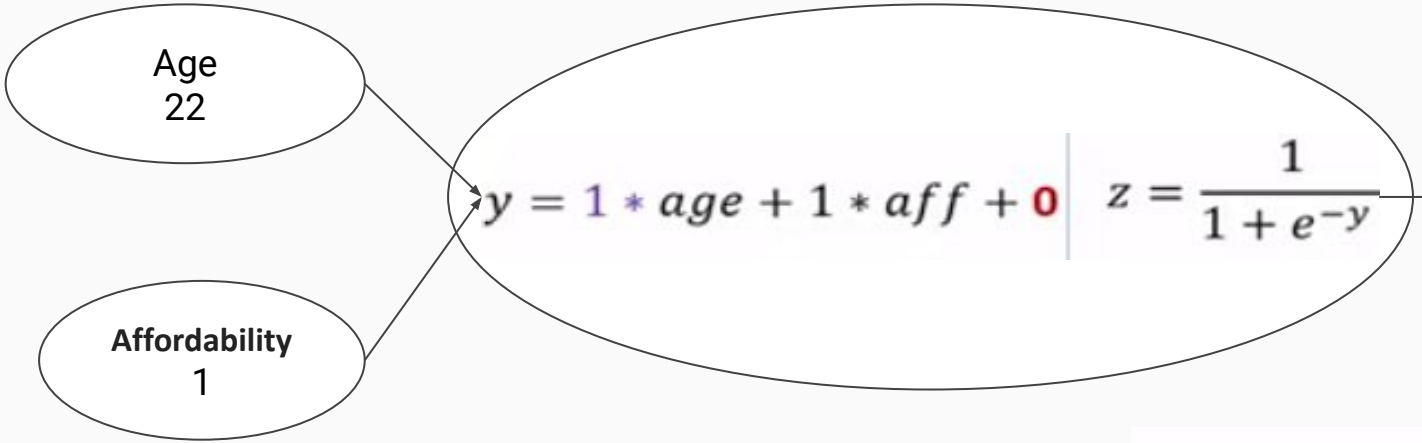
Insurance Data Table

Age	Affordability	Have_Insurance
22	1	0
25	0	0
47	1	1
52	1	1
46	1	1
56	1	1
55	1	1
60	1	1
62	1	1
61	1	1
18	1	0
28	0	1
27	0	0

Loss Function for ANN

$$y = w1 * x1 + w2 * x2 + bias$$

Age Affordability



Yp= 0.99

Y=0

$$error_2 = abs(y - \hat{y})$$
$$= 0.99$$

$$Mean\ Absolute\ Error\ (MAE) = \frac{1}{n}\sum_{i=1}^{n} abs(y_i - \hat{y}_i)$$

```
model.compile(optimizer='adam',
              loss='mean_absolute_error',
              metrics=['accuracy'])
```

$$Mean\ Squared\ Error\ (MSE) = \frac{1}{n}\sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

```
model.compile(optimizer='adam',
              loss='mean_squared_error',
              metrics=['accuracy'])
```

$$Log\ loss\ or\ binary\ cross\ entropy = -\frac{1}{n}\sum_{i=0}^{n} y_i \log(\hat{y}_i) + (1 - y_i) \cdot \log(1 - \hat{y}_i)$$

```
model.compile(optimizer='adam', loss='binary_crossentropy', metrics=['accuracy'])
```

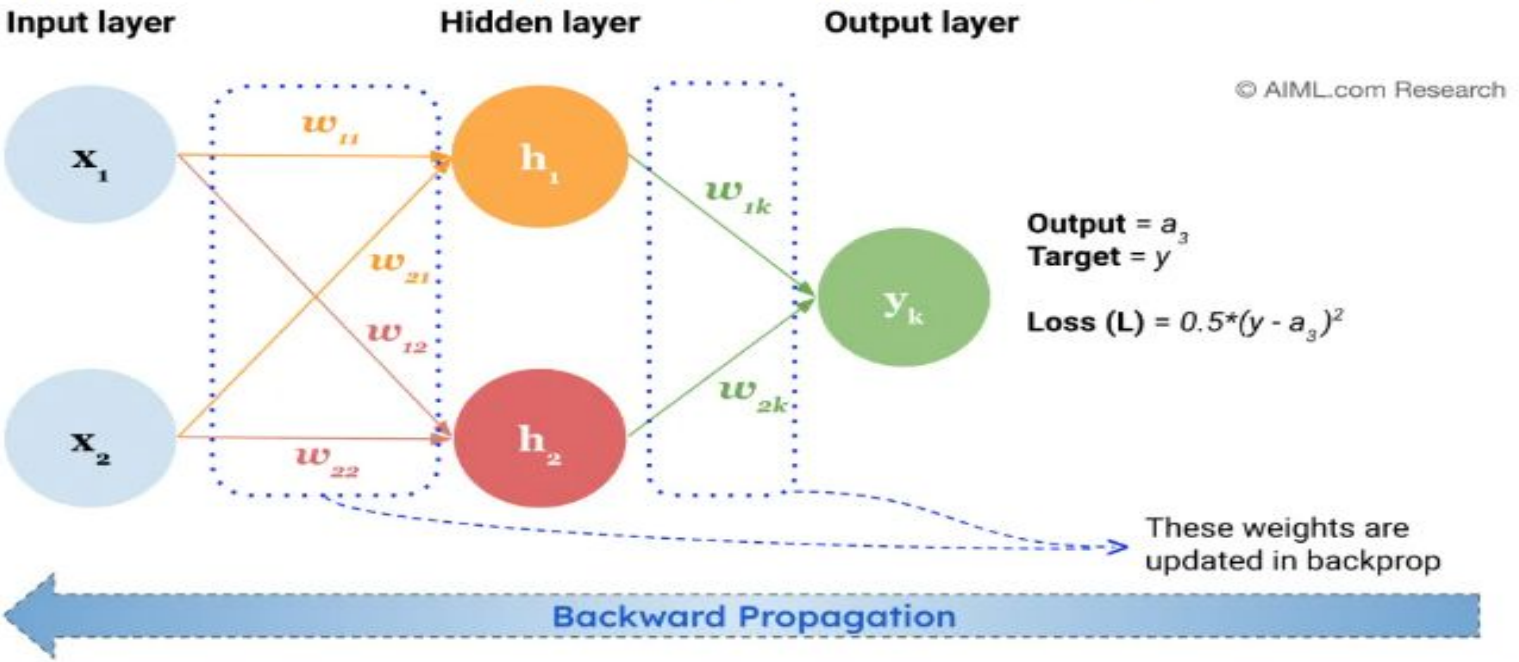
Classification WorkFlow for Fraud Detection

Key Concepts of Artificial Neural Networks

Backpropagation and Training

- **Backpropagation** is the process by which an ANN learns by updating weights and biases based on the error (loss).
- During backpropagation, the error is calculated at the output layer and propagated backward through the network. The **gradient descent** algorithm (or one of its variants) adjusts the weights and biases to reduce the error.
- This process of adjusting weights is repeated over many iterations (epochs) until the network reaches a satisfactory level of accuracy.

Classification WorkFlow for Fraud Detection 9/



- In stochastic gradient descent, weights (w_{ij}) are updated as below:
  $w_{ij} := w_{ij} + -\eta * \partial L(w_{ij}) / \partial w_{ij}$, where η is the learning rate and $\partial L(w_{ij}) / \partial w_{ij}$ is the gradient of loss w.r.t the model weights
- Intermediate variables calculated during forward propagation ($z_1, z_2, z_3, a_1, a_2, a_3$) are used for gradient calculation $\partial L(w_{ij}) / \partial w_{ij}$

Classification WorkFlow for Fraud Detection

CNN

Artificial Intelligence has been witnessing a monumental growth in bridging the gap between the capabilities of humans and machines. Researchers work on numerous aspects of the field to make amazing things happen. One of many such areas is the domain of Computer Vision.

Computer vision is a field of computer science that works on enabling computers to see, identify and process images in the same way that human vision does, and then provide appropriate output.

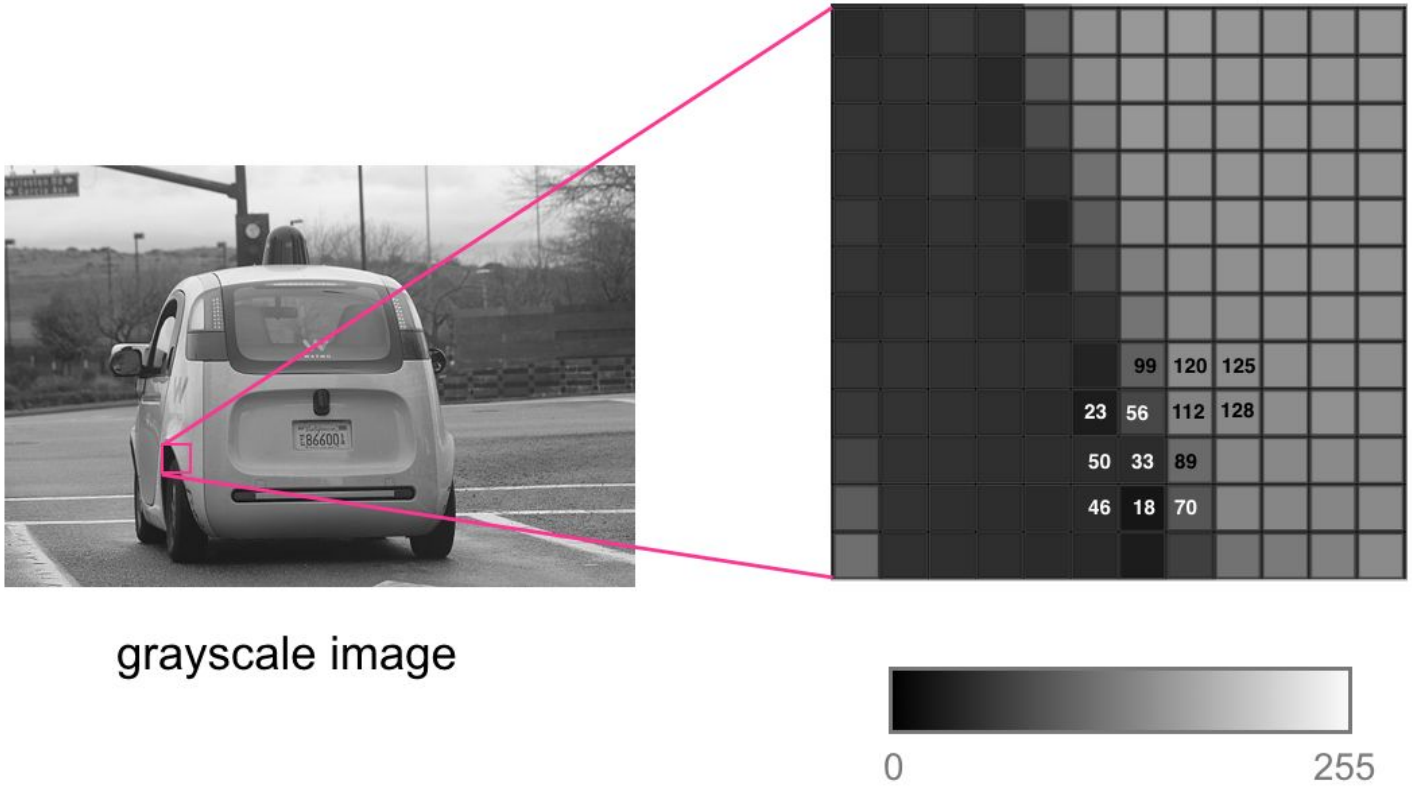
Classification WorkFlow for Fraud Detection

CNN

• A Convolutional Neural Network (CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights) to various objects in the image and be able to differentiate one from the other.

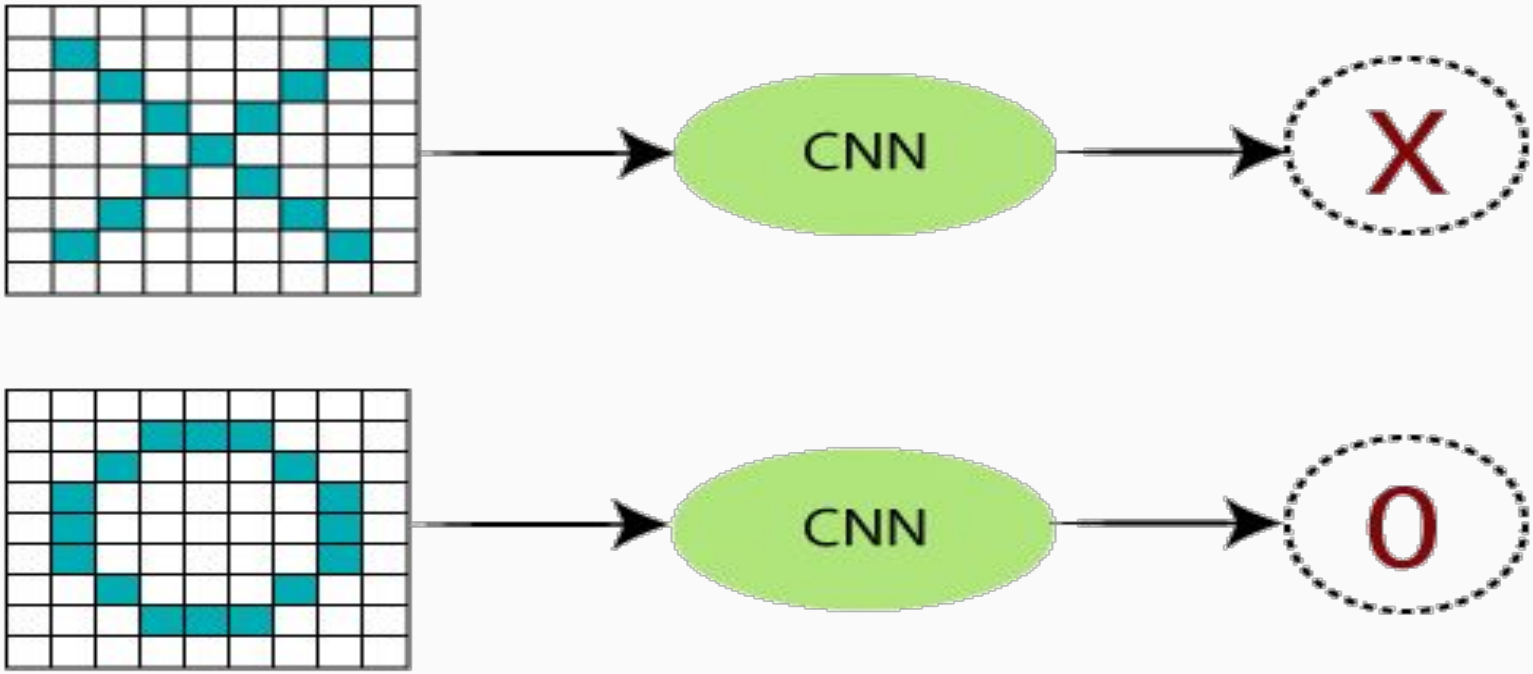
• The preprocessing required in a CNN is much lower as compared to other classification algorithms.

Classification WorkFlow for Fraud Detection

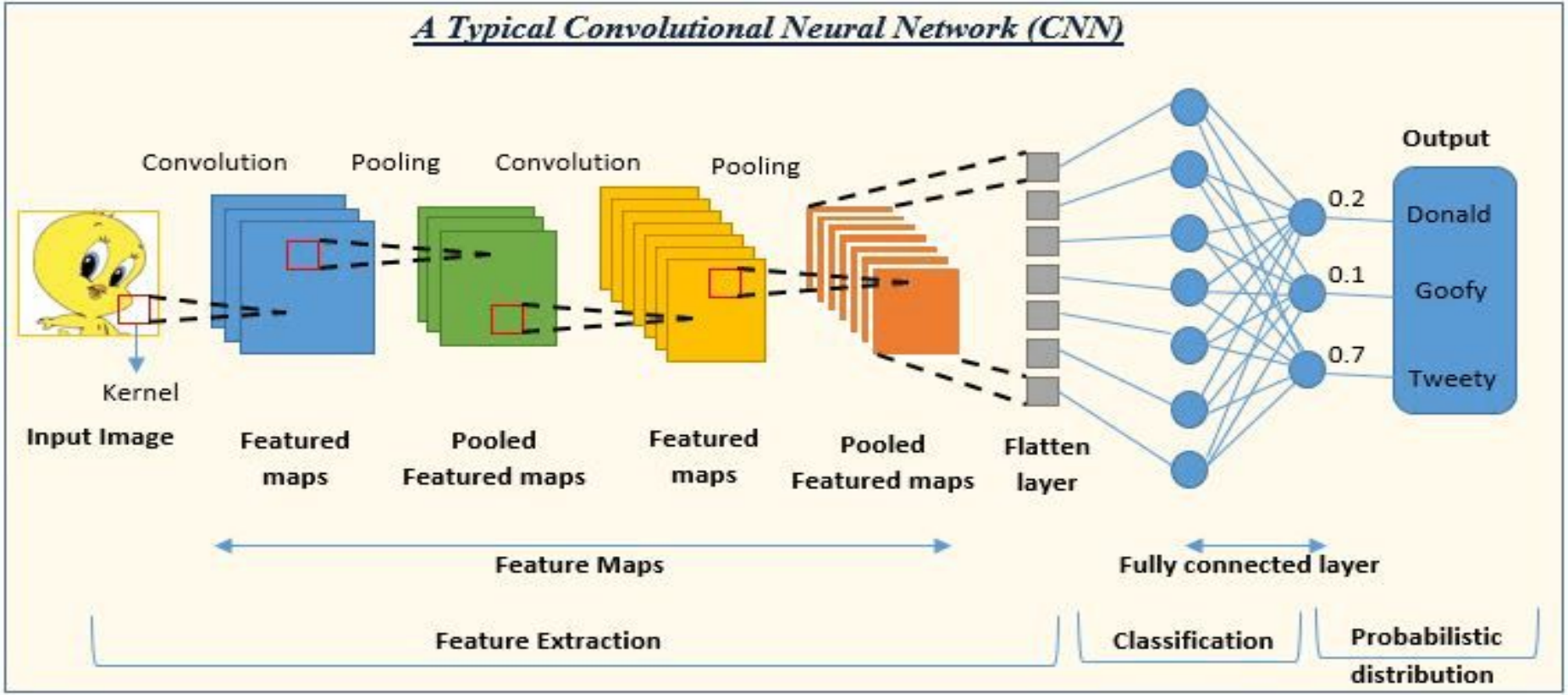


Classification WorkFlow for Fraud Detection

CNN



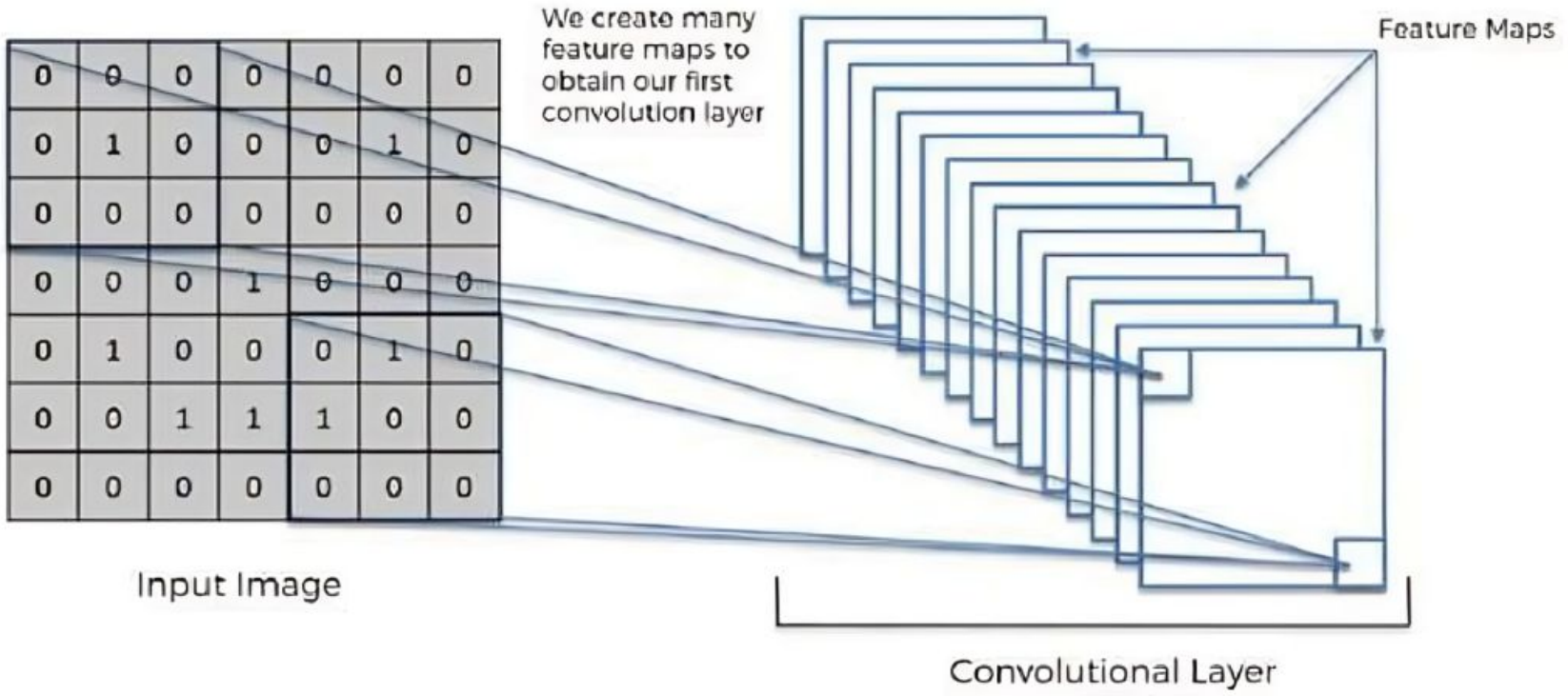
CNN WorkFlow



ReLu

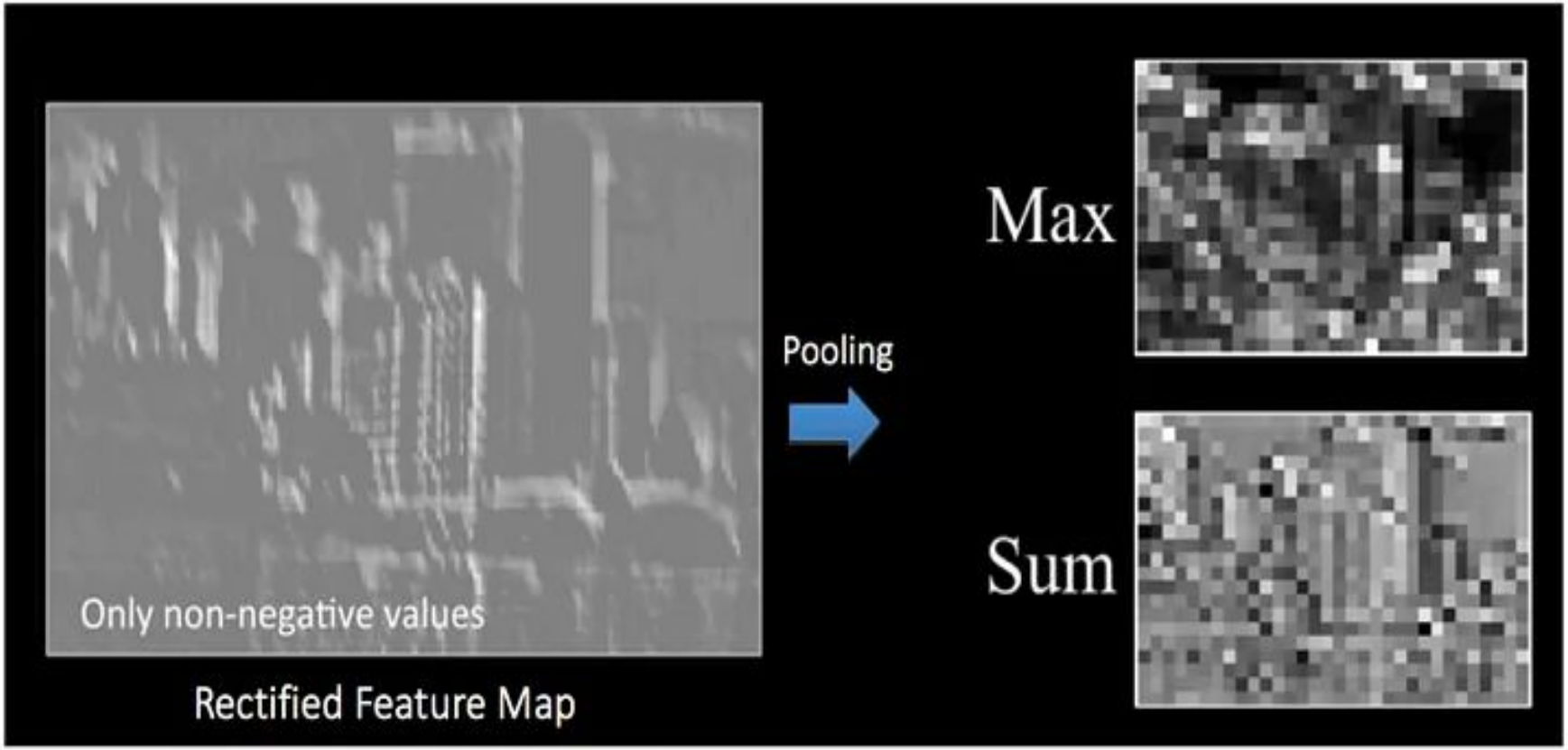
The ReLU (Rectified Linear Unit) activation function is widely used in neural networks, especially in Convolutional Neural Networks (CNNs), due to its simplicity and effectiveness in introducing non-linearity. Here's why ReLU is often applied after convolution operations:

Convolutional (Sliding Filter)



Pooling

- A pooling layer is another building block of a CNN.
- This is basically a function which reduces the pixels of the 'Feature Map' and changes it into a Pooled Feature Map. A common technique is Max Pooling.


Only non-negative values
Rectified Feature Map
Pooling
Max
Sum

Flatting

Flattening is converting the data into a 1-dimensional array for inputting it to the next layer. We flatten the output of the convolutional layers to create a single long feature vector. And it is connected to the final classification model, which is called a fully-connected layer.