

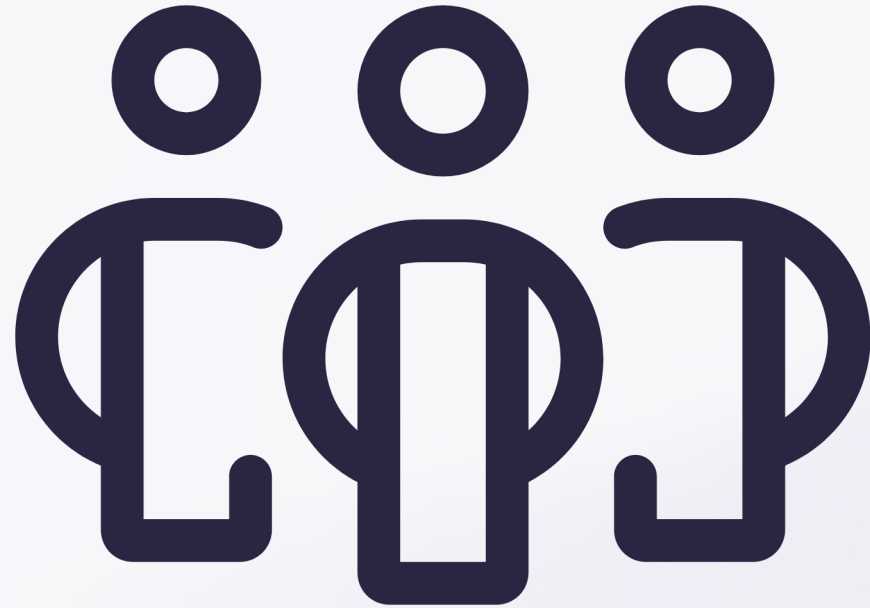
# AI-Driven Product Matching with Neural Networks

## For ISUPPLY

This presentation explores using Neural Networks for automated product matching. We will delve into data preprocessing, model architecture, and performance results. Discover how AI can transform product matching, enhancing efficiency and accuracy in e-commerce.



# Meet Our Team: Collaborating for Success



**Today, we are here with you Omar Ashraf and Tarek Muhammad. Together, we worked seamlessly to bring this project to life**

# Pipelines of our Presentation :

## 1 Main Problem

The manual process of product matching on the master sheet is time-consuming and error-prone

## 2 Suggested Solution

We developed an automated product matching system using machine learning and neural networks

## 3 Tools & Frameworks

We used Pandas, NumPy, Scikit-learn, TensorFlow, Keras, SciPy, NLTK, Matplotlib, Seaborn, Arabic Reshaper, Bidi, and WordCloud for data processing, modeling, and visualization.

## 4 Data Analysis

We analyzed and preprocessed data using EDA, feature selection, and resampling techniques to improve model accuracy.

## 5 Data Preprocessing

We cleaned and structured the product data, handled duplicates, and optimized features for accurate matching

## 6 Model Architecture

We implemented and fine-tuned multiple models to achieve high-accuracy product matching with 99.21% Accuracy

## 7 Results Of The Solution

Our system improved efficiency, reduced errors, and achieved high accuracy in product matching

## 8 The Final Steps of Our Solution

We handled the users' data for better efficiency and conducted rigorous performance validation.

# The Product Matching Problem

## Why Automation is Key ?



### Manual Matching Challenges

Manual product matching is labor-intensive. It's also prone to errors and inconsistencies.



### Scalability Issues

Scaling manual processes is difficult. It cannot keep up with growing product catalogs.



### Automation Benefits

Automation ensures accuracy and efficiency. It also enables handling large datasets easily.

# Our Solution

## A Neural Network Approach

### 1 Neural Network Advantages

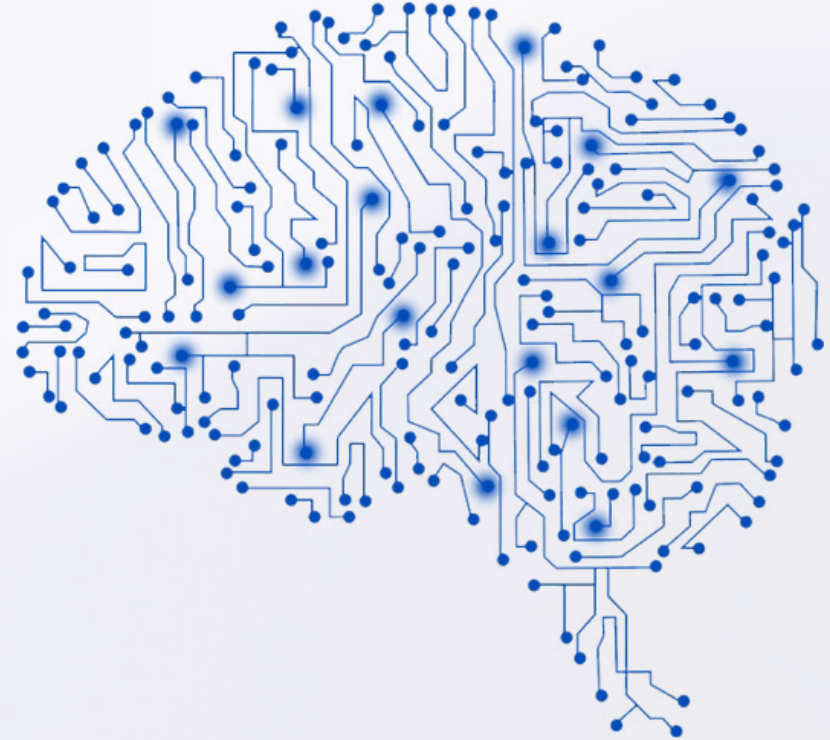
NNs learn complex patterns automatically. They also adapt to new data effectively.

### 2 High Accuracy

NNs provide superior matching accuracy. This reduces manual review significantly.

### 3 Scalable Solution

The NN model scales easily. It handles expanding product inventories seamlessly.



# Tools & Frameworks

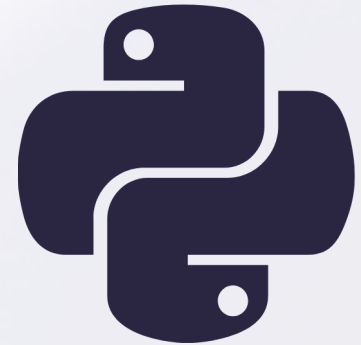
**Programming & Data Processing:** Python, Pandas, NumPy, SQL

**Machine Learning & Deep Learning:** Scikit-learn, TensorFlow, Keras

**Text Processing & NLP:** NLTK, Arabic Reshaper, Bidi

**Data Visualization:** Matplotlib, Seaborn, WordCloud

**Scientific Computing:** SciPy



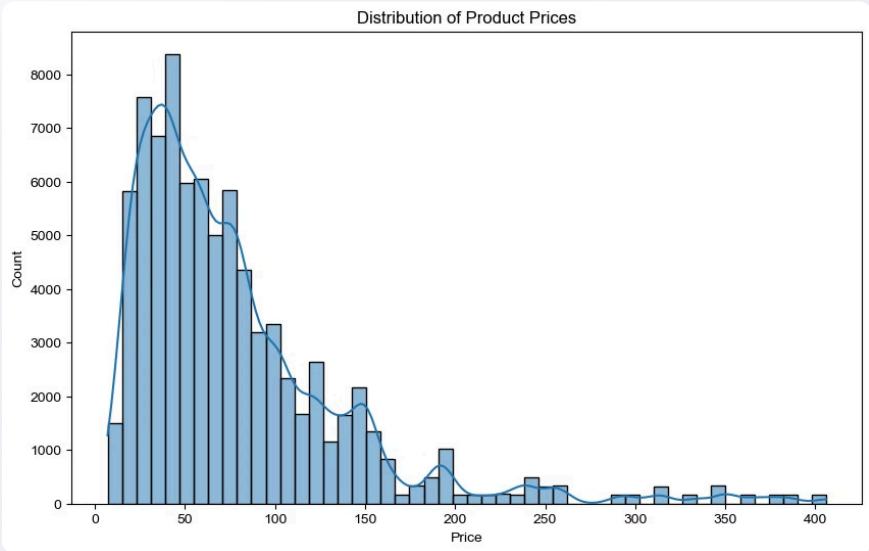
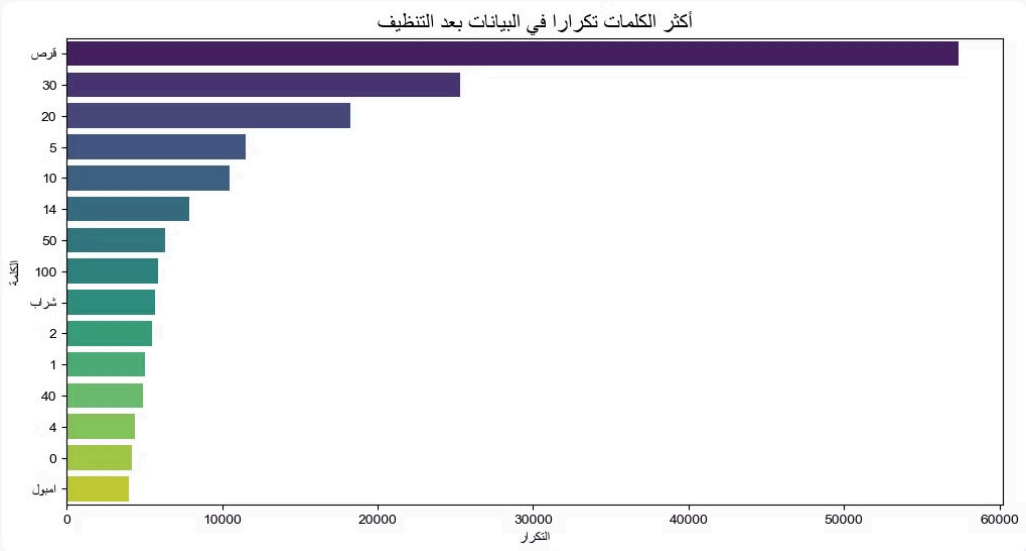
**These tools enabled efficient data cleaning, preprocessing, feature engineering, model training, and visualization for accurate product matching.**

# Data Analysis

We analyzed the dataset to clean, preprocess, and extract key insights:

- Word Frequency Analysis:** The bar chart shows the most common words in product descriptions after preprocessing. Words like "قرص" (tablet) and "شراب" (syrup) appeared frequently, helping refine feature selection for product matching.
- Price Distribution:** The histogram reveals a right-skewed distribution, indicating most products are in a lower price range. This helped detect outliers and improve data consistency.

These insights enhanced our model’s performance and accuracy.





# Data Preprocessing Pipeline

1

## Text Cleaning

Removing noise ensures data quality.

2

## Count Vectorization

Converting text to numerical features.

3

## Handling Patterns

Handling some patterns in the user messages  
for model stability.



# pre-processing Overview

**in pre-processing stage we clean and standardize product names to improve matching accuracy. It performs several key steps**

1. **Stopword Removal:** Removes common Arabic and English words that don't add value to product identification.
2. **Text Normalization:**
  - Unifies Arabic variations of letters (e.g., converting "ى" to "ي").
  - Removes unnecessary characters and repeated letters.
3. **Format Cleaning:**
  - Separates numbers from text to improve readability.
  - Removes special characters and unwanted symbols.
4. **Standardizing Product Forms:**
  - Replaces different terms for the same pharmaceutical forms (e.g., "جيل" → "جل", "قرص" → "أقراص").
  - Eliminates redundant descriptors like "عادي" or "قديم".

After processing, the cleaned text makes product names more consistent, reducing mismatches and improving search accuracy.

# Model Architecture

## Building a Powerful Neural Network with TensorFlow/Keras



### Multi-Layer Perceptron

Building a deep learning model with 10 layers



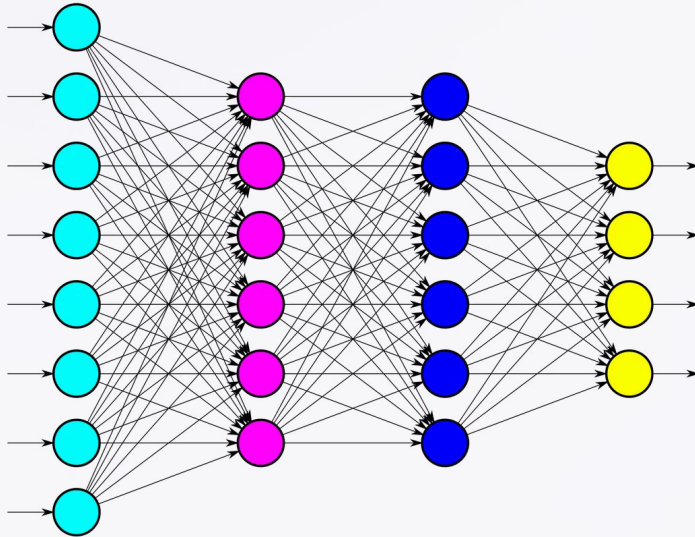
### Activation Functions

Using ReLU & softmax for non-linearity



### AdamW Optimizer

Optimizing model weights efficiently.



# Results

## High Accuracy & Robust Performance

Our neural network model demonstrated **strong and consistent performance** across all datasets, ensuring its reliability in product matching.

- **Balanced Accuracy:** The model achieved **high accuracy** not only on the training set but also on the validation and test datasets, confirming its effectiveness in real-world scenarios.
- **No Overfitting:** The close alignment between training, validation, and test accuracy scores indicates that the model **generalizes well** to unseen data, avoiding overfitting.
- **Reliable Predictions:** The consistent performance across different data splits ensures the model can effectively classify and match products with **high confidence**.

These results highlight the model's robustness, making it a **dependable AI solution** for product classification tasks.

# Steps For Our Automated Solution



1

## Text Preprocessing

Cleaning, tokenization, and vectorization (TF-IDF, Count Vectorization).

2

## Feature Engineering

Standardizing numerical data for better model efficiency.

3

## Neural Network Model

A deep learning model with **embedding layers, dense layers, and dropout** for robust classification.

4

## Performance Evaluation

Accuracy-based assessment ensuring **no overfitting**, with balanced **training, validation, and test scores**.

# Conclusion: Transforming Product Matching with AI

## Enhanced Efficiency

Automated matching saves time and effort.

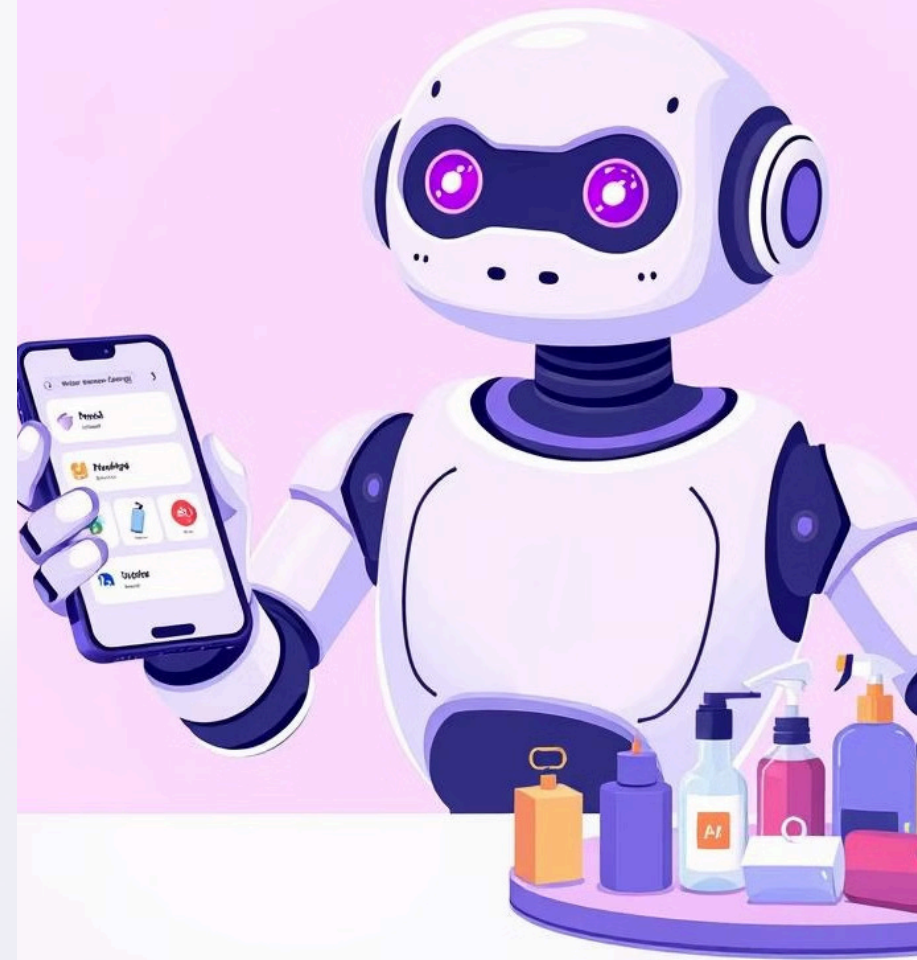
## Improved Accuracy

Neural Networks reduce matching errors.

## Scalable Solution

The NN model adapts to growing catalogs, with 99.21% Accuracy on the test set

AI-driven product matching improves efficiency and scalability. It also ensures superior accuracy. Embracing AI is key to staying competitive.



**Thank you for arriving here!**

**Tarek Muhammed and Omar Ashraf**



**were with you throughout this journey**

**Thank you for your time and support, special thanks to Faculty Of Computers and Artificial Intelligence at Cairo University and the ISUPPLY team. A heartfelt thanks to Seif El-Tohamy and Abdelrahman Mostafa for their valuable contributions to this project**



Thank you  
for watching!