



SPAM

HAM

NAIVE BAYES' THEOREM

Spam Ham Email Detection

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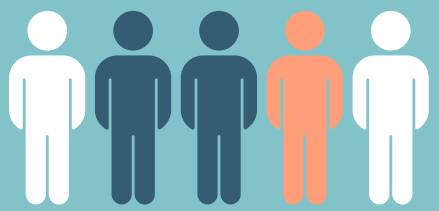
INTRODUCTION

What is the Problem?

- Spam emails waste time and pose security risks.
- Manual filtering is impossible at scale.

Solution Overview

- Utilize machine learning to automatically classify emails.
- Naive Bayes is a popular and effective model for this task.



What is Naive Bayes Theorem ?

Bayes' Theorem Formula:

$$* P(A|B) = P(B|A) \times P(A) / P(B)$$

In our case:

- A = Message is Spam
- B = The words in the message

Naive Assumption:

- Features (words) are independent
- Hence, "Naive" Bayes

Why Naive Bayes for Spam Detection ?

- Simple and fast to train
- Works well with text data
- Requires small training data
- High accuracy in practice



How It Works – Step by Step

Training Phase:

- Preprocess emails (remove stopwords, lowercase)
- Extract features (keywords)
- Count word frequencies in spam vs ham
- Calculate probabilities using Bayes' Theorem



Prediction Phase:

- For a new message, multiply the probabilities of each word
- The higher one decides the label
- Compare:
 - ✱ $P(\text{Spam}|\text{Words})$ vs $P(\text{Ham}|\text{Words})$

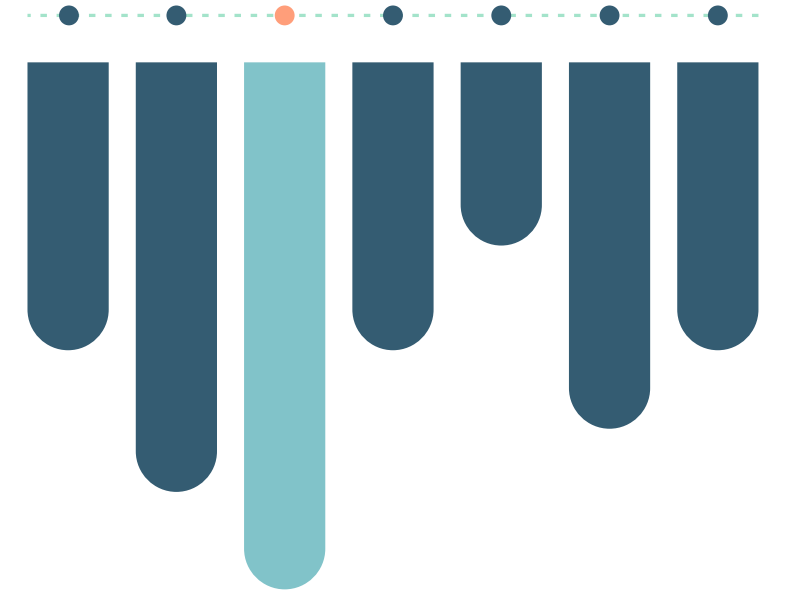
Dataset Overview

- Format: CSV File
- 1000+ messages labeled as:
- "Spam" (unwanted email)
- "Ham" (legitimate email)

Example:

- | | Message |
|----|------------------------------|
| 1. | "Win a FREE prize now!" |
| 2. | "Meeting at 3PM in Room 204" |

Category
Spam
Ham



Tools & Implementation

Tools Used:

- Python (Scikit-learn, NLTK, Pandas)
- Excel (Probability Calculation & Visualization)
- Tkinter GUI
- Matplotlib (Charts)



Excel-Based Naive Bayes Example

Message: "Claim your free offer now!"

Top 3 Words: claim, free, offer

Word	P(Word Spam)	P(Word Ham)
Claim	0.1364	0.0667
Free	0.2727	0.0667
Offer	0.0909	0.0667



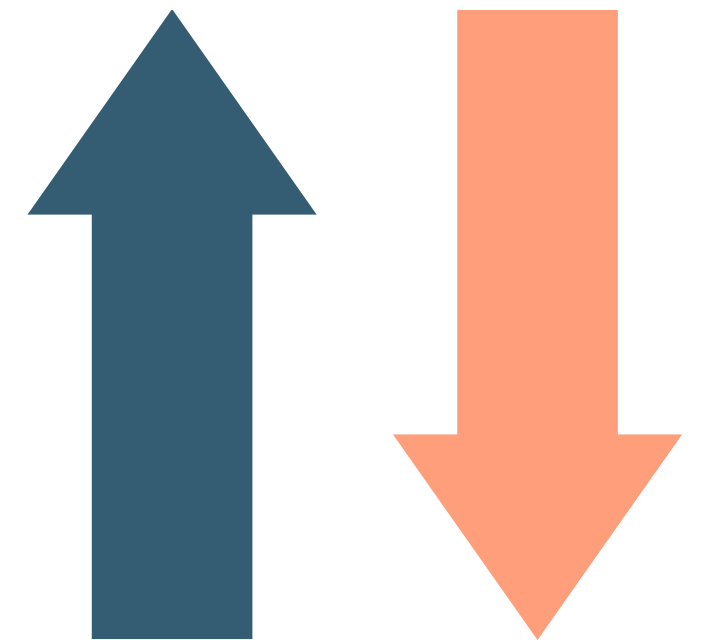
Prediction:

$P(\text{Spam})=0.00169 > P(\text{Ham})=0.00014$

\Rightarrow Spam

Results & Accuracy

- Accuracy of Model: ~95%
- Confusion Matrix & Evaluation Metrics shown in app
- Works well even on small datasets



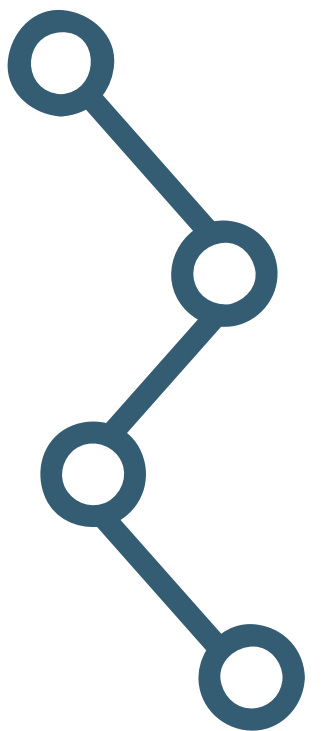
Limitations & Assumptions

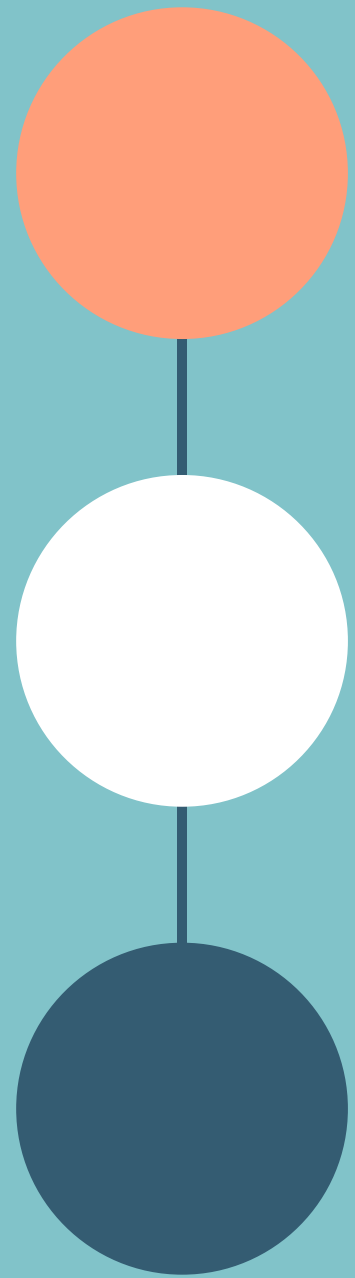
- Assumes independence between words (which may not be true)
- Might struggle with very short messages
- Doesn't consider word order or context



Conclusion

- Naive Bayes is a powerful tool for spam detection
- Easy to implement, fast, and accurate
- Combined with GUI and Excel, it gives a complete picture
- Great example of theory + real-world ML application





THANK YOU!
