

The Naive Bayes Algorithm: Takeaways

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Concepts

- When a new message w_1, w_2, \dots, w_n comes in, the Naive Bayes algorithm classifies it as spam or non-spam based on the results of these two conditional probabilities:

$$P(\text{Spam} | w_1, w_2, \dots, w_n) \propto P(\text{Spam}) \times \prod_{i=1}^n P(w_i | \text{Spam})$$
$$P(\text{Spam}^C | w_1, w_2, \dots, w_n) \propto P(\text{Spam}^C) \times \prod_{i=1}^n P(w_i | \text{Spam}^C)$$

- The Naive Bayes Algorithm relies on the assumption of conditional independence to make calculations easier
- To calculate $P(w_i | \text{Spam})$ and $P(w_i | \text{Spam}^C)$, we need to use the additive smoothing technique:

$$P(w_i | \text{Spam}) = \frac{N_{w_i | \text{Spam}} + \alpha}{N_{\text{Spam}} + \alpha \times N_{\text{Vocabulary}}}$$

$$P(w_i | \text{Spam}^C) = \frac{N_{w_i | \text{Spam}^C} + \alpha}{N_{\text{Spam}^C} + \alpha \times N_{\text{Vocabulary}}}$$

Resources

- [A technical intro to a few version of the Naive Bayes algorithm](#)
- [An intro to conditional independence](#)