# Bayesian Statistics Basics

## Introduction

Bayesian statistics is a mathematical approach that uses probability to express uncertainty about events and parameters. It is named after Thomas Bayes, who introduced the fundamental theorem.

## Core Concepts

### Bayes' Theorem

The foundation of Bayesian statistics is Bayes' theorem:

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| B) = P(B |

Where:

* P(A) is the prior probability
* P(B) is the evidence

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### Prior and Posterior Probabilities

* Prior: Initial belief about a parameter before seeing data
* Posterior: Updated belief after observing evidence

## Applications

### Medical Diagnosis

* Calculating probability of disease given test results
* Updating diagnosis probabilities with new symptoms

### Machine Learning

* Parameter estimation in models
* Classification problems
* Uncertainty quantification

### Scientific Research

* Hypothesis testing
* Experimental design
* Data analysis

## Advantages

* Incorporates prior knowledge
* Provides uncertainty estimates
* Updates beliefs systematically
* Works well with small datasets

## Limitations

* Choice of prior can be subjective
* Computationally intensive
* May require expertise to implement

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