# Bayesian Statistics Basics

## Introduction

Bayesian statistics is an approach to statistics based on Bayes' Theorem, where probability expresses a degree of belief in an event. Unlike frequentist statistics, Bayesian statistics allows for the incorporation of prior knowledge or beliefs.

## Bayes' Theorem

The fundamental equation is:

|  |
| --- |
| B) = P(B |

Where:

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

|
|  |
|

## Key Concepts

1. \*\*Prior Probability\*\*: Initial belief before new evidence
2. \*\*Likelihood\*\*: Probability of the data given the hypothesis
3. \*\*Posterior Probability\*\*: Updated belief after considering new evidence

## Applications

* Medical diagnosis
* Machine learning and AI
* Risk assessment
* Quality control
* Image analysis
* Scientific research

## Simple Example

Medical Test Scenario:

* Prior: 1% of population has disease
* Test accuracy: 95% true positive rate
* If test is positive, Bayes' Theorem helps calculate actual probability of having disease

## Advantages

* Incorporates prior knowledge
* Provides probability distributions
* Updates beliefs with new data
* Handles uncertainty well

---