

ENGG2780 Statistics for Engineers

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Abstract

This is a note for **ENGG2780 - Statistics for Engineers** for self-revision purpose ONLY. Some contents are taken from lecture notes and reference book.

Mistakes might be found. So please feel free to point out any mistakes.

Contents are adapted from the lecture notes of ENGG2760, prepared by **Sinno Jialin Pan**, as well as some online resources.

This course heavily relies on prior knowledge of probability (which you can refer to in the notes I wrote for **ENGG2760**). Therefore, before proceeding with this course, make sure you understand the foundation, as I will assume familiarity with probability concepts.

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Chapter 1

Bayesian Statistic

1.1 Statistic v.s. Probability

Statistics focuses on real-life applications where the underlying distribution is often unknown. To address this, we use **statistical inference** to analyze observed data and estimate the unknown distribution. Rather than finding the exact distribution, we approximate it using models such as parametric (e.g., normal, exponential) or non-parametric approaches. Once a suitable model is chosen, probability laws help us make predictions and draw conclusions, though these approximations involve assumptions and uncertainties.

Statistics and probability are closely related but serve different purposes. **Probability** predicts outcomes based on known models, while **statistics** analyzes past data to infer unknown distributions. Probability starts with assumptions and calculates outcomes, whereas statistics starts with data to estimate models.

Despite their differences, the two fields are interdependent. Probability provides the foundation for statistical inference, while statistics helps validate probability models using real-world data. In short, probability predicts based on models, while statistics builds models from data.

Now, let's move on to our first topic in statistics:

1.2 Bayesian Statistics

In the probability course, we learned Bayes' Rule (ENGG2760: Theorem 3.2.1), which helps us calculate conditional probabilities and, at times, update our beliefs based on new evidence.

Chapter 2

Known Bugs