Guidelines for Effective Application of Statistical Method
For Use in Engineering & Scientific Settings

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Abstract

This paper is intended to highlight some of the issues and provide recommendations regarding the appropriate application of statistical methods to the fields of engineering and science. The target audience is individuals who are working to improve processes and product designs by understanding causal relationships. This causality is annotated with the symbolic expression, $Y=f(x)$. A challenge is to communicate statistical concepts and tools to the engineering community using terminology not universally understood. Definitions at the end of this paper should assist in the translation.

Questions stimulating the discussion below include: What statistics are useful? What does it mean to *apply* statistics? How does one apply statistics to their field of study? How should data be collected? How should data be analyzed? What statistical technique should be used? How are the outputs of statistical analysis interpreted? What does statistical significance mean? How can the data be used to predict?

The application of statistical thinking and methods can greatly enhance the efficiency and effectiveness of any engineering or scientific study. The following list of guidelines provides some foundational "advice" for the appropriate application of analytical statistics. The order is unimportant.

Guideline 1: It All Depends on How the Data is Collected

Guideline 2: Investigations are Question Driven. Statistical Techniques Better Enable You to Answer Engineering Questions

Guideline 3: Understand Variability, Variation Exists in Everything

Guideline 4: Plan and Predict

Guideline 5: Keep It Simple and Sequential…*Stupid* (sic)

Guideline 6: Statistical Analysis Requires Interpretation from the Lens of the Engineer or Scientist

Guideline 7: Question and Evaluate the Integrity of the Data

Guideline 8: Have a Strategy to Learn About and Handle Noise