Why study model-based mathematical statistics?

Model-based mathematical statistics is a critical tool used in many experiments, both scientific and industrial, as it allows data to be classified, organized and analyzed. As such, the reason to study model based mathematical statistics is to develop a model that best describes the experiment which can be used by other scientist in order to verify if the experiment is valid or not, and efficiently analyze large sets of data.

Model-based mathematical statistics is used by researchers everywhere as a way to conceptualize, draw conclusions, and assess the effectiveness of data. By developing a model for an experiment, one inherently develops a map that explains the full data set, and thus a way for others to reproduce the experiment and test if the hypotheses are valid. This is important as if an experiment cannot be reproduced accurately then it questions the validity of the experiment and of the hypotheses. Furthermore, mathematical models provide a general overview of the data set, and as such proper interpretation of specific aspects of the model can yield specific data of the experiment. This is important if others want to extract specific data from an experiment without going thru the hassle of preforming the experiment themselves. Finally, by using the mathematical model one can test the effectiveness of the model in other experiments and thus use the model as a basis to develop a new model to best classify the new data.

Another important aspect of model-based statistics is its effectiveness in classifying large data sets when it hard to analyze the entire dataset. For example, if one was trying to determine the amount of defective computer chips in a batch of computers, it would not be economical to test each computer individually. Rather, it would be efficient to test a small sample of computers, analyze the defective models, and develop a general mathematical model that applies to all the computers to determine the defective batch. This way companies can still get an accurate count of defective models economically. Furthermore, in situations where it the sample size is unknown, a statistical model can provide the answer. Situations like determining the number of trees in a forest. The most efficient way is to develop a statistical model that characterizes a small area of the forest and then apply the model to full forest.

These only describe a small number of scenarios in which statistical theory is useful, and as such useful to study. As society continues to progress and preform research, statistical theory will continue grow into a more prominent role in helping analyze the research.