The Debut of Stat-Ease® 360

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Agenda

- Design-Expert
- Stat-Ease 360 Launch
- Stat-Ease 360 Features
- Conclusion
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Design-Expert

- Design-Expert (DX) has been a leading software package in the design and analysis of experiments (DOE).
- Originally developed in the mid-1980s by Pat Whitcomb, DX provides cutting-edge, easy-to-use tools that don’t require lengthy, formal statistical training.
Some highlights of our most recent releases:

- **DX9 (2013)**
  - Split-plots and mixed models

- **DX10 (2016)**
  - DX 64-bit available
  - Multicore support for computations

- **DX11 (2017)**
  - Entire UI overhauled
  - Mac version available

- **DX12 (2019)**
  - Logistic regression, multiple graphs, KCV models

- **DX13 (2020)**
  - Poisson regression, multiple analyses, column rounding
Design-Expert – Going Forward

• Over the years, Stat-Ease has received steady requests for more advanced DOE tools.

• We’ve also received some demand for tools that are adjacent to DOE, such as design and analysis of computer experiments, Gage R&R (measurement systems analysis), more computing capabilities, statistical process control, and many more.

• In the interest of keeping Design-Expert as simple and accessible as possible, we have historically tabled these types of requests.

• The demand is now too great to wait!
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• Stat-Ease 360 (SE360) will be released October 4, 2021.
• It contains a full copy of Design-Expert software.
• The first release of SE360 will also contain some of our most highly-requested advanced DOE features:
  • Optimal space-filling designs
  • Latin hypercube designs
  • Gaussian process models for zero-error data
  • Python scripting
  • Advanced classification tools for logistic regression
• Going forward, Design-Expert will continue to be targeted towards engineers, formulators, and others working in R&D. Remember, SE360 contains all of DX.

• Going forward, easy-to-use and bread-and-butter techniques will go into both DX and SE360.

• Highly-advanced, non-DOE, and highly technical & computational features will only go into SE360. Some ideas we have for the future:
  • Measurement Systems Analysis
  • Statistical Process Control
  • Multivariate Analysis
  • Advanced Scripting/Computing
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Design and Analysis of Computer Experiments

• Computer experiments can differ from physical experiments in the following ways:
  • For a given set of factors, the output is deterministic (no error)
  • A computer simulation, rather than a physical experiment in the lab, is run to obtain the output.
  • Repeating a simulation for a given set of factors will usually produce identical results.
  • Each run can be extremely time-intensive to obtain.
  • Because there is no error, certain desirable features of experimental designs, like replicates, no longer make sense.
Design and Analysis of Computer Experiments

**Physical Experiment**

**Computer Experiment**

```
import pefile
import os
API_list = []
PATH = "C:\VMware_Samples"
for FILE in os.listdir(PATH):
    current_file = os.path.join(PATH, FILE)
    pe = pefile.PE(current_file)
    for entry in pe.DIRECTORY_ENTRY_IMPORT:
        for API in entry.imports:
            API_LIST.append(API.name)
```
• Because the output has no error, replicates don’t make sense.

• Designs for computer experiment are typically space-filling – that is, they aim to cover the design space without leaving large gaps between design points.

Maximin Space-filling Design

D-optimal Design
Stat-Ease 360 has two major offerings for space-filling designs:

- Optimal space-filling designs (model-based and distance-based)
- Latin Hypercube Designs:
Design and Analysis of Computer Experiments

• DEMO: Space-Filling Designs in Stat-Ease 360

Note: Space-filling designs can be used for physical experiments as well!

• Common use cases:
  • Aerospace
  • Medical devices
  • Logistics
Next Question: how do we analyze this type of data?

Ordinary polynomial models are often not adequate for modelling data that comes from a computer experiment.

Suppose we collect data that looks like this:
A polynomial OLS model would look like this:
• The big issue is that the model should predict the response perfectly, since there is no error!

• It is impossible to do this with a polynomial model, unless the model has as many terms as there are runs in the data set.

• Gaussian Process Models (GPMs) are one tool that are used to model zero-error data obtained from a computer experiment.

• **DEMO: Space-filling designs + GPMs in Stat-Ease 360**

• **Source:** https://www.statease.com/docs/se360/tutorials/gaussian-process-models/
Another highly-requested feature has been scripting. Stat-Ease 360 can incorporate Python scripts directly within the software.

Tomorrow (Wednesday) morning, Hank Anderson (VP of Software Development) will give a talk on this topic in more detail.

Hour 1: (Keynote) Hank Anderson (VP Software Development, Stat-Ease)

Python Integration with Stat-Ease 360 - A Tutorial
Python Scripting Capabilities

- Here is just a small sampling of what you will be able to do:
  - Write scripts to automate routine processes
  - Create simulations
  - Combine features of Stat-Ease 360 with features from relevant Python packages
  - Create infinitely customizable plots and graphs
  - Facilitate import/export of data between Design-Expert and other software
Python Scripting Capabilities
Advanced Classification Tools

• Logistic regression was added to Design-Expert in version 12.
• The purpose of logistic regression is to model binary 0/1 data, and to predict where a ‘1’ will occur:
Advanced Classification Tools

• Stat-Ease 360 offers a wide array of tools to assist with binary classification and prediction.

• These tools are much more advanced than what we would typically put into Design-Expert.

• **DEMO: Classification and Prediction tools in Stat-Ease 360**
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Conclusion

• Stat-Ease 360 will be available October 4, 2021.
• It will be available for both Windows and Mac.
• Only a 64-bit version will be available.
• SE360 is essentially a pro/advanced version of Design-Expert. It will also include non-DOE engineering tools in the future.
• Consider attending the 2021 Stat-Ease summit tomorrow (Wednesday), which will feature a one-hour demo of the Python scripting capabilities of SE360.
• This launch is only the beginning – more to come!
• If you have any questions, please do not hesitate to reach out to us.
Thanks for listening!

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