论文写作规范

七、研究中的实验及数据处理

刘帅

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软件学院 206

Outline

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   - Baselines
   - Persuasive Data
   - Interpretation
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   - Variables
   - Reporting variability
   - Statistical Tools
   - A "Statistical Principles" Checklist

Experiments are an essential part of sound science.
Tests should be **fair**.

Baselines

- Your results should be compared to **the best previous method**.
- Update the choice of baseline to the latest.
- What if you solve an existing problem in a novel way that is for some reason not comparable to previous work? Potential point of comparison: the first workable option that a reasonable person might suggest.

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- –[what data] their characteristics
- –[mechanisms] need to be normalized or cleaned up
- –[Sufficiency] larger data sets offer different statistical properties. data volumes need to be large enough to ensure that the experiment will be able to detect the effect that is being hypothesised.
  the number of data sets: A single data set may not be persuasive

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- Limits: Knowledge in the data is needed to help assess the significance of the results, and to then, as far as possible, rectify 矫正 the data. This may involve, for example, careful manual data processing, following explicit guide-lines.

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- **reference data sets**. Allow the direct comparison of work between institutions and between papers. It carries risks, that is, methods can become so specialized that they do not work on other data.
- Verify that what you are testing is what you intended to test, and an experiment should only succeed if the hypothesis is correct. Ask whether a single data set is sufficient.
  To what volumes of data should your claims apply?

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- Don't draw undue 过度 conclusions or inferences 推论. If, say, one method is faster than another on a large data set, and they are of the same speed on a medium data set, that does not imply that the second is faster on a small data set; it only implies that different costs dominate at different scales.

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- Predictivity： the conclusions in our papers are usually about properties of systems, not their behaviour on the data we have already seen.

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- Should the data be seeded with examples to test the validity of the outcomes?

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- Will the reported results be comprehensive or a selection? Will the selection be representative?

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- Are the experiments feasible? Do you have the resources (time, machines, data, code, humans) required to undertake them to a reasonable standard?

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- Is the code going to be made publicly available? If not, why not?

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- Is ethics clearance required? 伦理审查：1. 参与者为自愿参与并且可以随时退出. 2. 已经给参与者提供了关于项目的相关信息. 3. 数据进行匿名及保密. 4. 对参与者权益的保护

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- have a clear understanding of the relevant parameters

Samples and Populations.

- "algorithm new is typically faster than algorithm old ": to claim that new is faster on average.
- (Such a statement could as easily be made on the basis of a theoretical analysis as on the basis of experiments.)
- But an average of what? If the intended meaning is only that new is faster than old on average for **the runs undertaken in the experiments**, what is it about **these runs** that makes them representative or predictive?

- population: the set of all possible runs
- But in all likelihood the population is infinite, as it must contain all possible combinations of input data
- It is necessary to resort to taking a sample

The task may be qualitatively changed.

For instance, a search engine will achieve the same effectiveness on a given query and collection of Web pages each time it is run, but will achieve different scores for different queries or different collections—which may be due to the new data changing the nature of the task. In cases where the tasks change qualitatively, it may not be meaningful to talk about a population, sample, or average, so other strategies for interpretation of results may be appropriate.

Reporting variability

- Averaging provides valuable insight into typical behaviour.
- A descriptive statistic is **standard deviation**
- You can report quantiles, such as the 25th to 75th percentiles, combined with the median.
- An **odd number** of experimental runs is preferable to an even number, since the middle run will be the median

Statistical Tools

- Measures of correlation are used to determine whether two variables depend on each other.
- Regression is used to identify the relationship between two variables.
- hypothesis testing 统计假设检验 Hypothesis tests are used to investigate whether improvements are significant. It is often the case that, in a series of comparisons of two techniques for the same task, one is better than the other some but not all of the time.
- there are packages that do much of the hard work. Second, many statistical problems can be couched in terms of elementary probability and then resolved computationally.

Visualization of Results

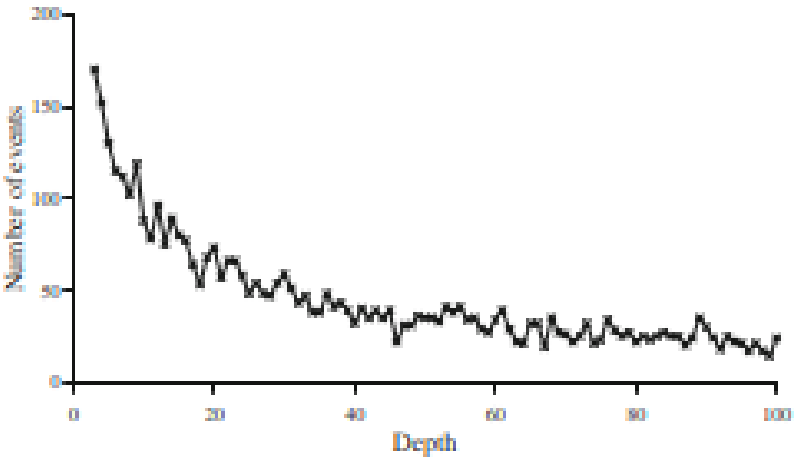
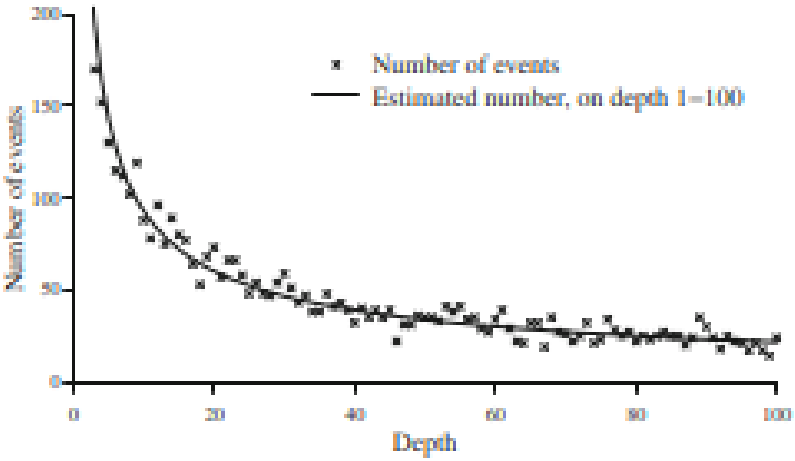


FIGURE 7. *The number of events observed at each depth; depths 1 and 2 have been omitted for reasons of scale.*



The solid line shows a best-fit to the points.

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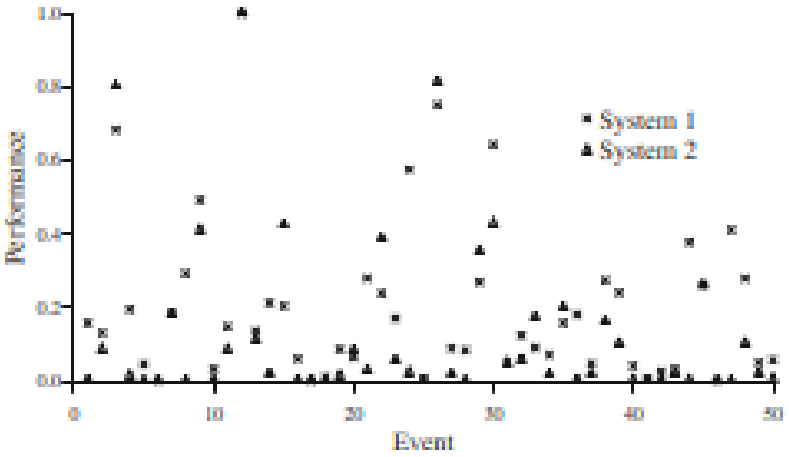
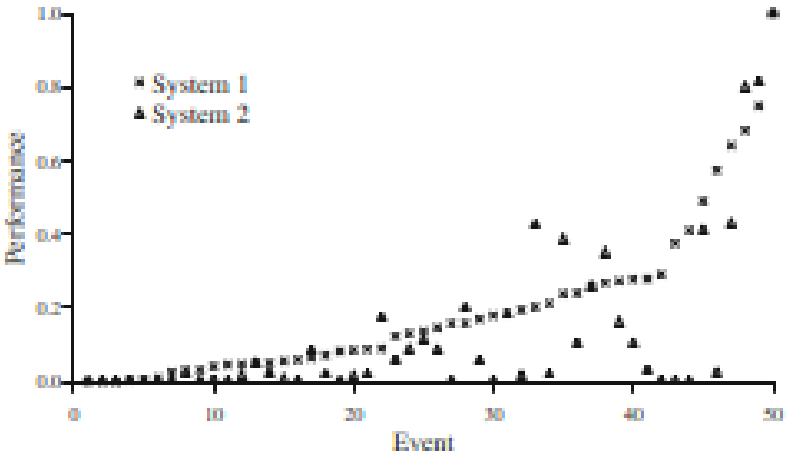


FIGURE 3.3. *The ability of each system to respond to an event, for each of 50 events.*



In the lower graph in the figure, the events have been sorted by the performance on System 1.

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- How precise will the individual measurements be? How important is it to achieve a particular level of precision?

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- What visualizations might help provide insight into the pattern or behaviour of the results?