Research Project

Math 376, Fall 2013
Toews

Introduction

The bulk of this course consists of learning fundamental but standard material from our textbook. While textbook learning is appropriate at this level, knowing how to read a research article is also a valuable skill, and one you will definitely need if you end up using your statistics in a job (e.g. actuarial work, physical science, etc.) or in graduate school.

The purpose of this project is to have you investigate some topic of current statistical interest on your own, and to present your results in class. The investigation will entail reading “papers”, i.e. self-contained articles that develop or explain the relevant technique. The investigation should also involve a numerical illustration of the ideas via Matlab. Your job is to develop a roughly 15 minute in-class presentation during which you explain the ideas to your classmates.

Details

I’ve assigned a different project to each person:

<table>
<thead>
<tr>
<th>Name</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Julie</td>
<td>Principle Component Analysis (PCA)</td>
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<tr>
<td>Luke</td>
<td>Kalman Filter</td>
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<tr>
<td>Warren</td>
<td>Multidimensional Scaling (MDS)</td>
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I’ve given each person one or two articles to read and some Matlab code. Your task is to understand the key ideas and explain them to the rest of us. In trying to understand the concepts, please not that you are not limited to the sources I have given you: you can use any source you choose. Easy points of departure include Wikipedia and Mathworld, as well as textbooks you find in the library. You can also look for alternative research papers, perhaps papers that give other, more revealing examples.

While there is no unambiguous definition of what constitutes a good talk, here are some questions you might ponder:

- What is this technique used for? Describe some applications (in layman’s terms)
- How does the technique “work”, i.e. what is the underlying mathematical algorithm? Devote a couple of slides (or some board time) to explicitly showing us how the algorithm works. This should involve equations.
- Does the technique make any mathematical or statistical assumptions? If so, list them.
• Can you give an example of the technique in action? Matlab would be a good tool to do this: you could run some code for us, or simply show the results of the code (i.e. an image.)
• Where might the technique break down? This question might admit a speculative answer.

I recommend using powerpoint to do your presentation. A 15 minute talk doesn’t require that many slides: 10-15 should be adequate. Make sure each slide is simple and self-contained. I’d like to review your slides before you give your presentation, and will offer constructive feedback.

Grading:

Your presentation will be graded for content and style, as follows:
   A A fluid, engaging talk that illustrates the technique clearly
   B A talk that has strong elements, but also elements that are confusing or tangled.
   C A talk that is markedly confusing and/or poorly prepared.
   D A talk that is clearly last minute, confusing, and ill-conceived
   F A talk that is worse than any of the above

Dates:

Monday, November 25: conference with me regarding your topic. (Have an outline of what you want to say, and/or questions about the content.)
Tuesday, December 3: Draft of slides due in dropbox by 5pm
Monday, December 9: Presentation