

ISyE 6416 Homework 1; Regression in R

X. Huo

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1. Submit your report and software in a single file in canvas.gatech.edu. Online submission only.
2. The file names should be

6416_Last Name_First Name.pdf (or .zip or .docx, etc).

(2% penalty for not following this instruction.)

3. Due time: Thursday, January 25, 9:30AM. Later submission has a penalty that is described in the syllabus.
4. Report writing advisories are attached at the end.
5. Start earlier, to avoid last minute technical difficulty.
6. For handwritten (acceptable however not encouraged) solutions, scan into PDF file for submission.

Problem Description.

The attached data set (`w_logret_3automanu.txt`) includes weekly log returns of three auto manufacturers: Toyota Motor Corp., Ford Motor Corp., and GM. Treat the log returns of GM as response and log returns of Toyota and Ford as predictors. Fit a linear regression model in R. Perform necessary model diagnostics. Is linear regression a useful tool for this data set? Do you need to do any model selection?

Write a report to a banker who thinks that linear regression can be utilized, so that he can use the log returns of Toyota and Ford to interpret the log returns of GM. Your conclusion can go either way. Your justification should be convincing.

Report Writing. You may imagine that you are actually writing a short conference paper. See more on the next page.

First Impressions: Writing a Good Abstract

Because an abstract often determines if a published paper or dissertation will be read or ignored, a writer needs to pack persuasive information into a few words.

If an abstract answers the Seven Key Questions in the box to the right, it is likely to be complete and enticing.

A single sentence may answer or signal the answer to more than one of the seven questions. For example, Importance, Contribution, and Application may well be covered in the same few words, and a clear elucidation of the problem may well include other aspects.

Seven Key Questions

1. **Clear Focus.** Does the abstract make clear what work needed to be done, what problem needed to be solved?
2. **Method(s).** What method(s) were applied to address the problem? Why these particular methods?
3. **Importance.** Why should we care about this research?
4. **Context.** How does this work fit in with other work in the field?
5. **Results.** What, specifically, are the results? What evidence is given to convince us of those results?
6. **Unique Contribution.** What does this work report that is new?
7. **Possible Applications.** In what ways might this work be useful, either theoretically or practically?

Annotated Sample Abstract

This abstract is from “Directional Hypercomplex Wavelets for Multidimensional Signal Analysis and Processing” by Wai Lam Chan, Hyeokho Choi, and Richard G. Baraniuk, all in the ECE Department at Rice. The sentences are numbered for easier reference in the comments below.

Abstract	Comments on Each Sentence in the Abstract
<p>1. We extend the wavelet transform to handle multidimensional signals that are smooth save for singularities along lower-dimensional manifolds.</p> <p>2. We first generalize the complex wavelet transform to higher dimensions using a multidimensional Hilbert transform.</p> <p>3. Then, using the resulting hypercomplex wavelet transform (HWT) as a building block, we construct new classes of nearly shift-invariant wavelet frames that are oriented along lower-dimensional subspaces.</p> <p>4. The HWT can be computed efficiently using a 1-D dual-tree complex wavelet transform along each signal axis.</p> <p>5. We demonstrate how the HWT can be used for fast line detection in 3-D.</p>	<p>1. Instead of writing the all-too-common passive construction, “The wavelet transform is extended to handle...,” these authors take possession of and responsibility for the work with the opening word, “We.” (Those authors who cannot bring themselves to use “we” even in a multiple-author paper could use “This paper extends” as an alternative.) The verb “extend” not only precisely says what the work does, but also signals context. Clearly, this paper is based on specific prior work on “the wavelet transform” and expands possible applications of the earlier work to specific multidimensional signals. The problem is defined; applications are signaled. As one student said, “There’s a lot riding on that word extend,” and he’s right. Consider what would be lost if the word were the more common (and imprecise) “study” or “discuss.”</p> <p>2. “First” clearly signals to the reader that there will be more than one step in the method. The rest of the sentence gives details about what was done and links the sentence with the “multidimensional” in the title and in the first sentence.</p> <p>3. This second step in the sequence is clearly signaled and then precisely defined. Though the details are left for the body of the paper, enough is given here to illustrate the actual process.</p> <p>4. The shift to passive voice works here because it includes the reader as a possible user of this new any computer-driven research project, in which saving time translates to “saving money.”</p> <p>5. “Demonstrate” clearly signals results, evidence, and applications, as well as suggesting importance of the work. Repetition of “HWT” reinforces what has newly been added to the field, and “for fast line detection in 3-D” illustrates the promise of the title or a “multidimensional ” application of the wavelet transform.</p>

Verb choice in the five sentences illustrates a powerful writing technique. *Extend*, *generalize*, *construct*, *computed*, and *demonstrate* are precise and varied. Each verb signals an exact action necessary for the persuasive progression of the argument.

In summary, this brief abstract defines the focus of the paper, suggests its context, identifies and applies the methods used, shows why those methods work, gives specific results that echo the promise of the title, indicates what is new, and in the final sentence signals evidence for possible applications of this new technique. Impressive and persuasive in only 95 words!