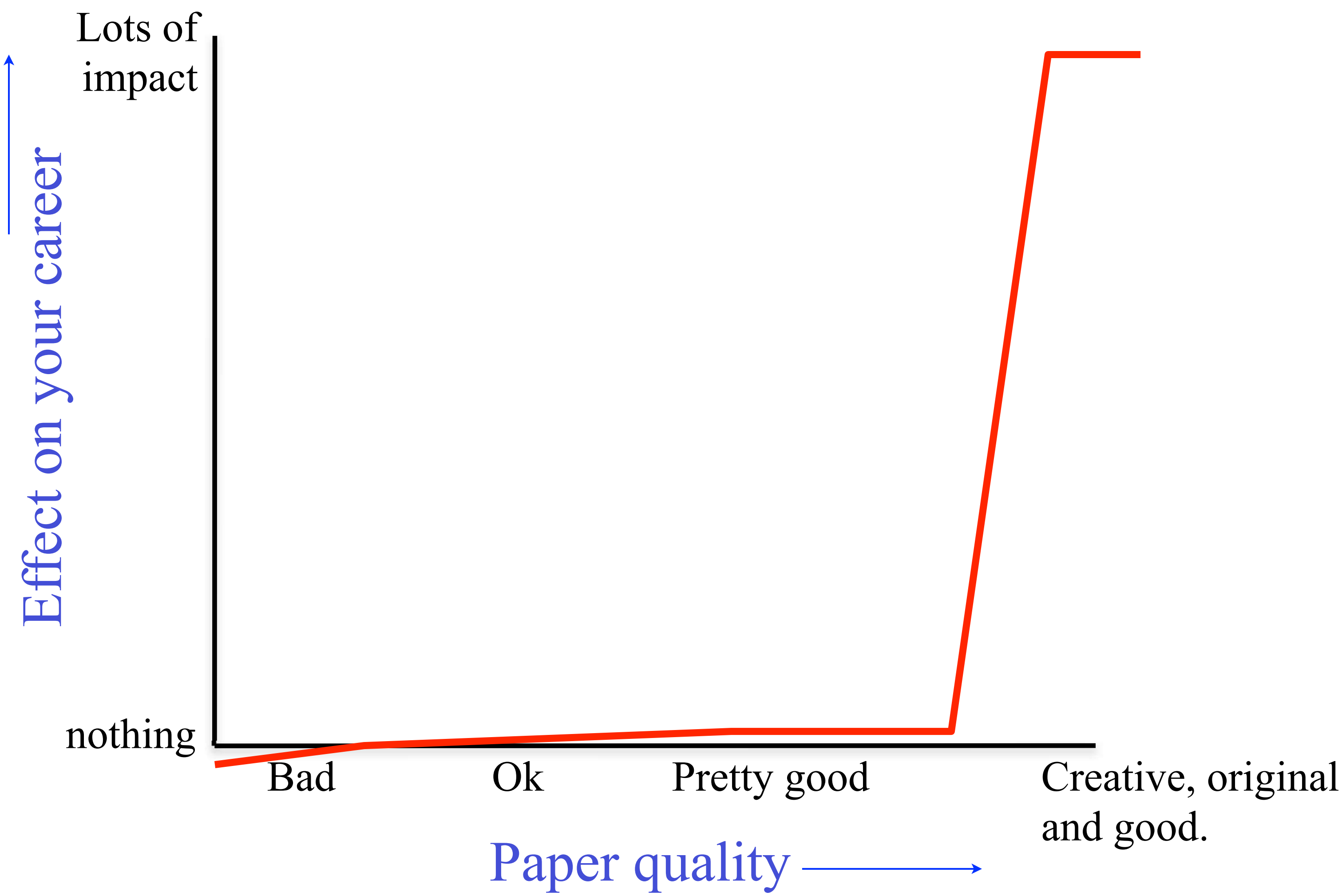
Artificial Intelligence II

Part 2: Lecture 12

Yalda Mohsenzadeh

Slides are adapted from Antonio Torralba and Philip Isola (MIT)

A paper's impact on your career



The reality:
more like a large, crowded marketplace

http://ducksflytogether.wordpress.com/2008/08/02/looking-back-khan-el-khalili/

Ted Adelson on how to write a good paper

(1) Start by stating which problem you are addressing, keeping the audience in mind. They must care about it, which means that sometimes you must tell them why they should care about the problem.

(2) Then state briefly what the other solutions are to the problem, and why they aren't satisfactory. If they were satisfactory, you wouldn't need to do the work.

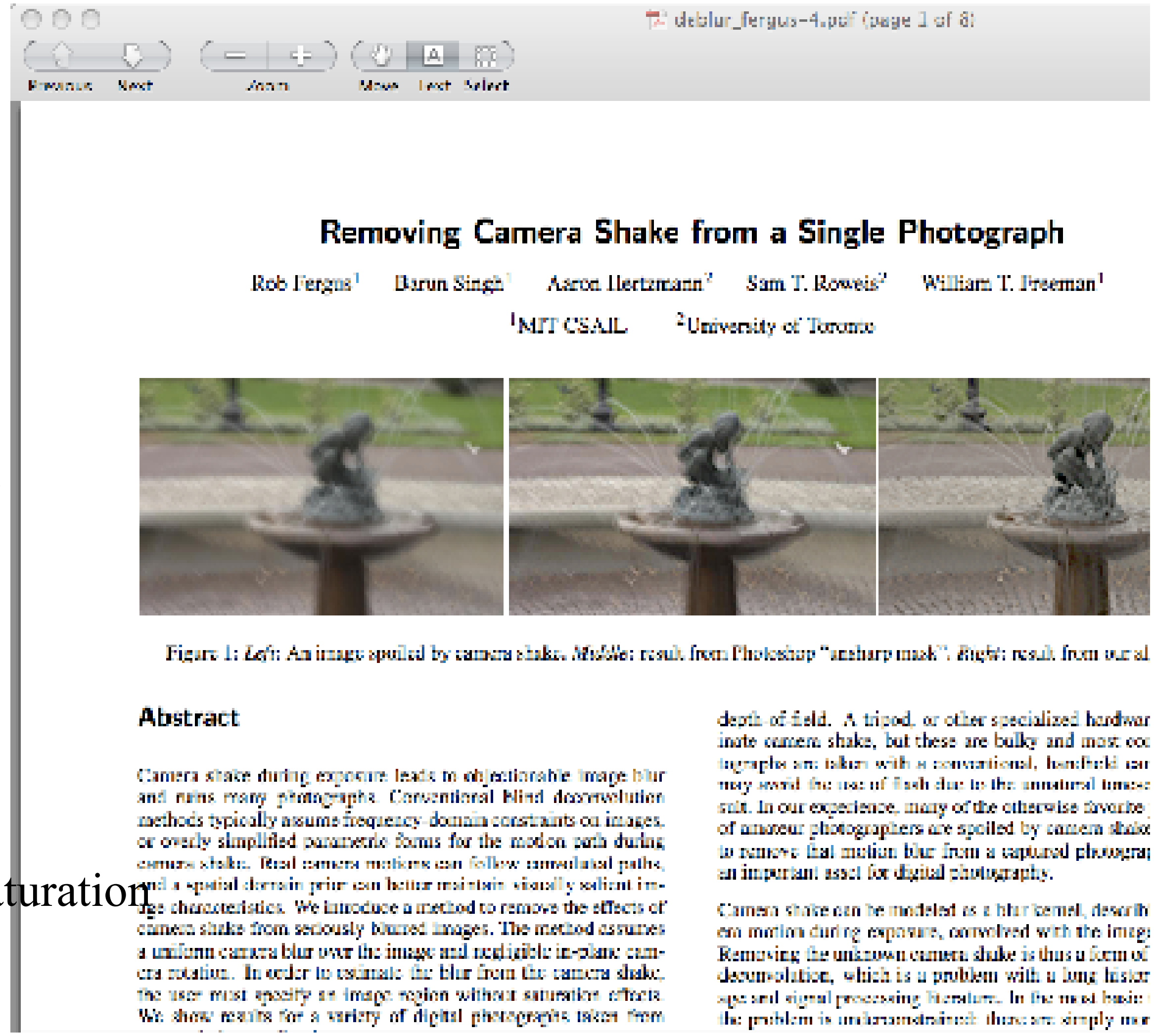
(3) Then explain your own solution, compare it with other solutions, and say why it's better.

(4) At the end, talk about related work where similar techniques and experiments have been used, but applied to a different problem.

Since I developed this formula, it seems that all the papers I've written have been accepted. (told informally, in conversation, 1990).

Example paper organization: removing camera shake from a single photograph

- 1 Introduction
- 2 Related work
- 3 Image model
- 4 Algorithm
  - Estimating the blur kernel
    - Multi-scale approach
    - User supervision
  - Image reconstruction
- 5 Experiments
  - Small blurs
  - Large blurs
  - Images with significant saturation
- 6 Discussion



The introduction

1 Introduction
2 Related work
3 --Main idea--
4 Algorithm
    - Estimating the blur kernel
        - Multi-scale approach
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5 Experiments
    - Small blurs
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Jim Kajiya: write a dynamite introduction

You must make your paper easy to read. You've got to make it easy for anyone to tell what your paper is about, what problem it solves, why the problem is interesting, what is really new in your paper (and what isn't), why it's so neat. And you must do it up front. In other words, you must write a dynamite introduction.

Underutilized technique: explain the main idea with a simple, toy example.

1 Introduction
2 Related work
3 Main idea
4 Algorithm
    Estimating the blur kernel
        Multi-scale approach
        User supervision
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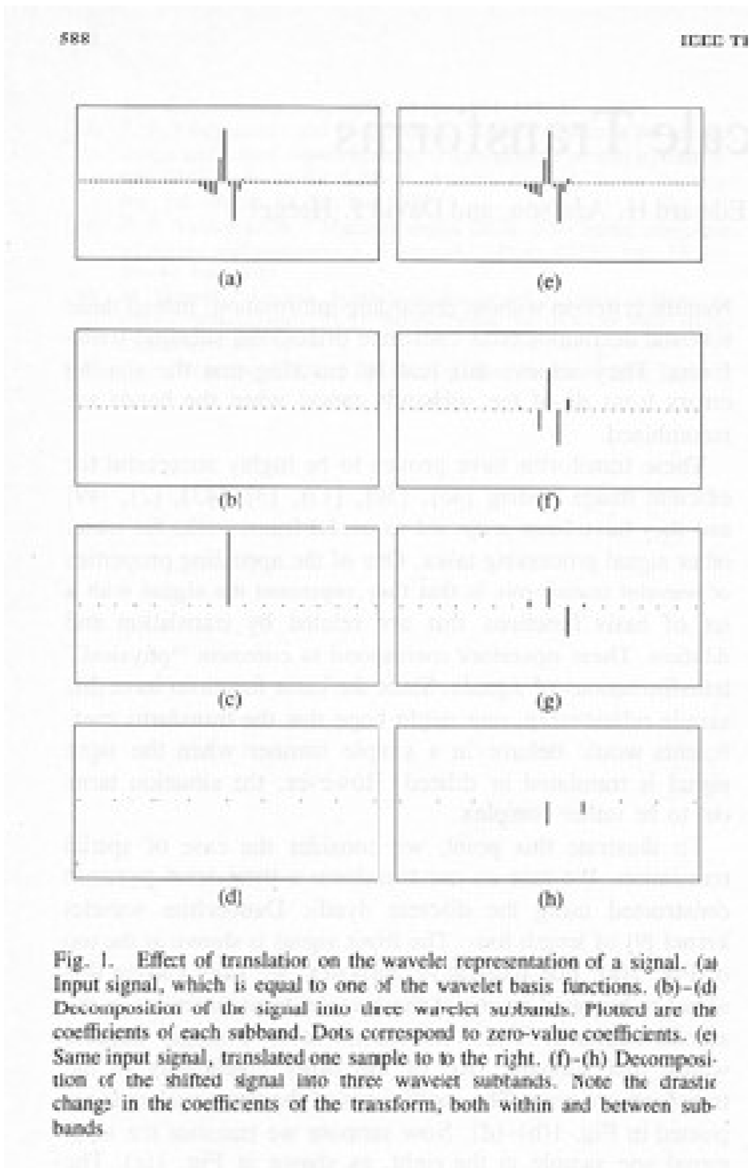
5 Experiments
    Small blurs
    Large blurs
    Images with significant saturation
6 Discussion

Often useful here.

Show simple toy examples to let people get the main idea



(a) (e)

(b) (f)

(c) (g)

(d) (h)

Fig. 1. Effect of translation on the wavelet representation of a signal. (a) Input signal, which is equal to one of the wavelet basis functions. (b)–(d) Decomposition of the signal into three wavelet subbands. Plotted are the coefficients of each subband. Dots correspond to zero-value coefficients. (e) Same input signal, translated one sample to to the right. (f)–(h) Decomposition of the shifted signal into three wavelet subbands. Note the drastic change in the coefficients of the transform, both within and between subbands.

From "Shiftable multiscale transforms"

Experimental results are critical now at CVPR

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Methods	Dataset	two-view?	**si-full**	**si-env**	**si-hum**	**si-intra**	**si-inter**	**RMSE**	**Rel**
Russell *et al.* [31]	-	Yes	2.146	2.021	2.207	2.206	2.093	2.520	0.772
DeMoN [39]	RGBD+MVS	Yes	0.338	0.302	0.360	0.293	0.384	0.866	0.220
Chen *et al.* [3]	NYU+DIW	No	0.441	0.398	0.458	0.408	0.470	1.004	0.262
Laina *et al.* [17]	NYU	No	0.358	0.356	0.349	0.270	0.377	0.947	0.223
Xu *et al.* [46]	NYU	No	0.427	0.419	0.411	0.302	0.451	1.085	0.274
Fu *et al.* [7]	NYU	No	0.351	0.357	0.334	0.257	0.360	0.925	0.194
I	MC	No	0.318	0.334	0.294	0.227	0.319	0.840	0.204
$IFCM$	MC	Yes	0.316	0.330	0.302	0.228	0.323	0.843	0.206
$ID_{pp}M$	MC	Yes	0.246	0.225	0.260	0.233	0.273	0.635	0.136
$ID_{pp}CM$ (w/o d. cleaning)	MC	Yes	0.272	0.238	0.293	0.258	0.282	0.688	0.147
$ID_{pp}CM$	MC	Yes	0.232	0.203	0.252	0.224	0.262	0.570	0.129
$ID_{pp}CMK$	MC	Yes	**0.221**	**0.195**	**0.238**	**0.215**	**0.247**	**0.541**	**0.125**

Table 2. **Results on TUM RGBD datasets.** Different si-RMSE metrics as well as standard RMSE and relative error (Rel) are reported. We evaluate our models (light gray background) under different input configurations, as described in Table 1. *w/o d. cleaning* indicates the model is trained using raw MVS depth predictions as supervision, without our depth cleaning method. Dataset '-' indicates the method is not learning based. Lower is better for all error metrics.

Gone are the days of, "We think this is a great idea and we expect it will be very useful in computer vision. See how it works on this meaningless, contrived problem?"

How to end a paper

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Conclusions, or what this opens up, or how this can change how we approach computer vision problems.

How not to end a paper

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Future work?

I can't stand "future work" sections. It's hard to think of a weaker way to end a paper.

"Here's a list all the ideas we wanted to do but couldn't get to work in time for the conference submission deadline. We didn't do any of the following things: (1)..."

(You get no "partial credit" from reviewers and readers for neat things you wanted to do, but didn't.)

"Here's a list of good ideas that you should now go and do before we get a chance."

Better to end with a conclusion or a summary, or you can say in general terms where the work may lead.

General writing tips

Knuth: keep the reader upper-most in your mind.

12. Motivate the reader for what follows. In the example of §2, Lemma 1 is motivated by the fact that its converse is true. Definition 1 is motivated only by decree; this is somewhat riskier.

    Perhaps the most important principle of good writing is to keep the reader uppermost in mind: What does the reader know so far? What does the reader expect next and why?

Treat the reader as you would a guest in your house

Anticipate their needs: would you like something to drink? Something to eat? Perhaps now, after eating, you'd like to rest?

Writing style, from the elements of style, Stunk and White

13. **Omit needless words.**

Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should have no unnecessary lines and a machine no unnecessary parts. This requires not that the writer make all his sentences short, or that he avoid all detail and treat his subjects only in outline, but that every word tell.

Many expressions in common use violate this principle:

the question as to whether	whether (the question whether)
there is no doubt but that	no doubt (doubtless)
used for fuel purposes	used for fuel
he is a man who	he
in a hasty manner	hastily
this is a subject which	this subject
His story is a strange one.	His story is strange.

Re-writing exercise

The underlying assumption of this work is that the estimate of a given node will only depend on nodes within a patch: this is a locality assumption imposed at the patch-level. This assumption can be justified in case of skin images since a pixel in one corner of the image is likely to have small effect on a different pixel far away from itself. Therefore, we can crop the image into smaller windows, as shown in Figure 5, and compute the inverse J matrix of the cropped window. Since the cropped window is much smaller than the input image, the inversion of J matrix is computationally cheaper. Since we are inferring on blocks of image patches (i.e. ignoring pixels outside of the cropped window), the interpolated image will have blocky artifacts. Therefore, only part of xMAP is used to interpolate the image, as shown in Figure 5.

Before

We assume local influence--that nodes only depend on other nodes within a patch. This condition often holds for skin images, which have few long edges or structures. We crop the image into small windows, as shown in Fig. 5, and compute the inverse J matrix of each small window. This is much faster than computing the inverse J matrix for the input image. To avoid artifacts from the block processing, only the center region of xMAP is used in the final image, as shown in Fig. 5.

After

This editing benefits you twice: (1) you have 50% more space to tell your story, and (2) the text is easier for the reader to understand.

Figures and captions

It should be easy to read the paper in a big hurry and still learn the main points. Probably most of your readers will be skimming the paper.

The figures and captions can help tell the story.

So the figure captions should be self-contained and the caption should tell the reader what to notice about the figure.

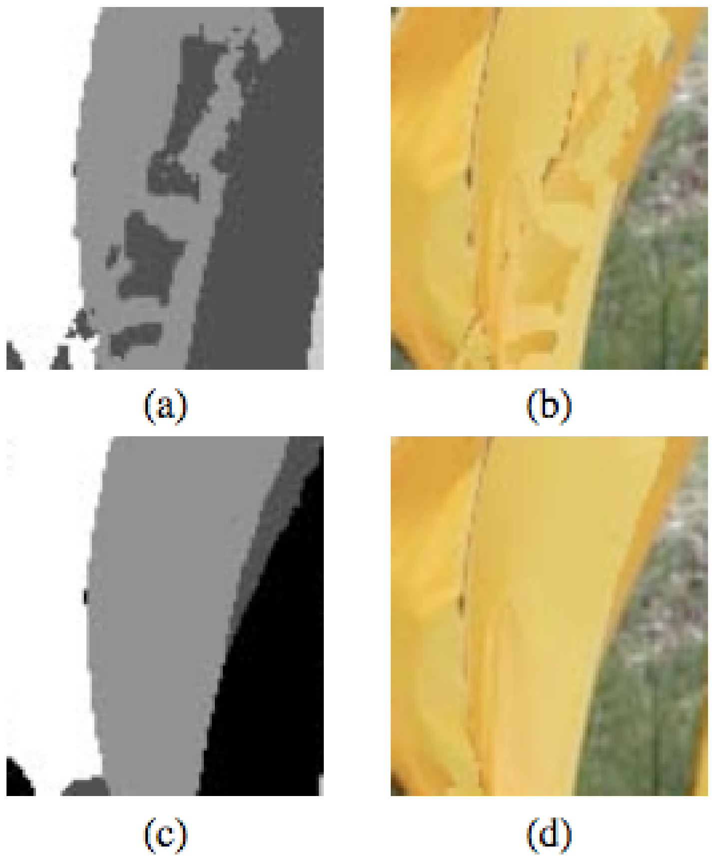

Figure 3: (a) Time-frame assignments for the front-most surface pixels, based on stereo depth measurements alone, without MRF processing. Grey level indicates the time-frame assignment at each pixel. (b) Shape-time image based on those assignments. (c) Most probable time-frame assignments, computed by MRF. (d) Resulting shape-time image. Note that the belief propagation in the MRF has removed spurious frame assignment changes.

Knuth on equations

13. Many readers will skim over formulas on their first reading of your exposition. Therefore, your sentences should flow smoothly when all but the simplest formulas are replaced by "blah" or some other grunting noise.

Mermin on equations

rule in your original manuscript.

Rule 2 (Good Samaritan rule). A Good Samaritan is compassionate and helpful to one in distress, and there is nothing more distressing than having to hunt your way back in a manuscript in search of Eq. (2.47) not because your subsequent progress requires you to inspect it in detail, but merely to find out what it is *about* so you may know the principles that go into the construction of Eq. (7.38). The Good Samaritan rule says: *When referring to an equation identify it by a phrase as well as a number.* No compassionate and helpful person would herald the arrival of Eq. (7.38) by saying "inserting (2.47) and (3.51) into (5.13) . . ." when it is possible to say "inserting the form (2.47) of the electric field **E** and the Lindhard form (3.51) of the dielectric function ϵ into the constitutive equation (5.13) . . . ."

Develop a reputation for being clear and reliable

(and for doing creative, good work…)

- There are perceived pressures to over-sell, hide drawbacks, and disparage others' work. Don't succumb. (That's in both your long and short-term interests).
- "because the author was [redacted], I knew I could trust the results." [a conference chair discussing some of the reasons behind a best paper prize selection].

Be honest, scrupulously honest

Convey the right impression of performance.

MAP estimation of deblurring. We didn’t know why it didn’t work, but we reported that it didn’t work. Now we think we know why. Others have gone through contortions to show why they worked.

Title?


IEEE TRANSACTIONS ON
INFORMATION THEORY
SPECIAL ISSUE ON WAVELET TRANSFORMS AND MULTIRESOLUTION SIGNAL ANALYSIS
PAPERS

Our title

- Was:
  - Shiftable Multiscale Transforms.
- Should have been:
  - What’s Wrong with Wavelets?

Quick and easy reasons to reject a paper

With the task of rejecting at least 75% of the submissions, area chairs are groping for reasons to reject a paper. Here's a summary of reasons that are commonly used:

- Do the authors not deliver what they promise?
- Are important references missing (and therefore one suspects the authors not up on the state-of-the-art for this problem)?
- Are the results too incremental (too similar to previous work)
- Are the results believable (too different than previous work)?
- Is the paper poorly written?
- Are there mistakes or incorrect statements?

Sources on writing technical papers

- How to Get Your SIGGRAPH Paper Rejected, Jim Kajiya, SIGGRAPH 1993 Papers Chair, http://www.siggraph.org/publications/instructions/rejected.html
- Ted Adelson's Informal guidelines for writing a paper, 1991. http://www.ai.mit.edu/courses/6.899/papers/ted.htm
- Notes on technical writing, Don Knuth, 1989.

  http://www.ai.mit.edu/courses/6.899/papers/knuthAll.pdf

- What's wrong with these equations, David Mermin, Physics Today, Oct., 1989. http://www.ai.mit.edu/courses/6.899/papers/mermin.pdf
- Notes on writing by Fredo Durand, people.csail.mit.edu/fredo/PUBLI/writing.pdf and Aaron Hertzmann, http://www.dgp.toronto.edu/~hertzman/advice/writing-technical-papers.pdf
- Three sins of authors in computer science and math, Jonathan Shewchuck, http://www.cs.cmu.edu/~jrs/sins.html
- Ten Simple Rules for Mathematical Writing, Dimitri P. Bertsekas http://www.mit.edu:8001/people/dimitrib/Ten_Rules.html