

# How to Read a Paper

(How reading a paper is different  
from reading a textbook)

Yaser Sheikh

# Newspapers and History

“Newspapers are the first rough draft of history”

Philip Graham (Washington Post)



Research Papers : Science Textbooks :: Newspapers : History Textbooks

Research papers are the first rough draft of science

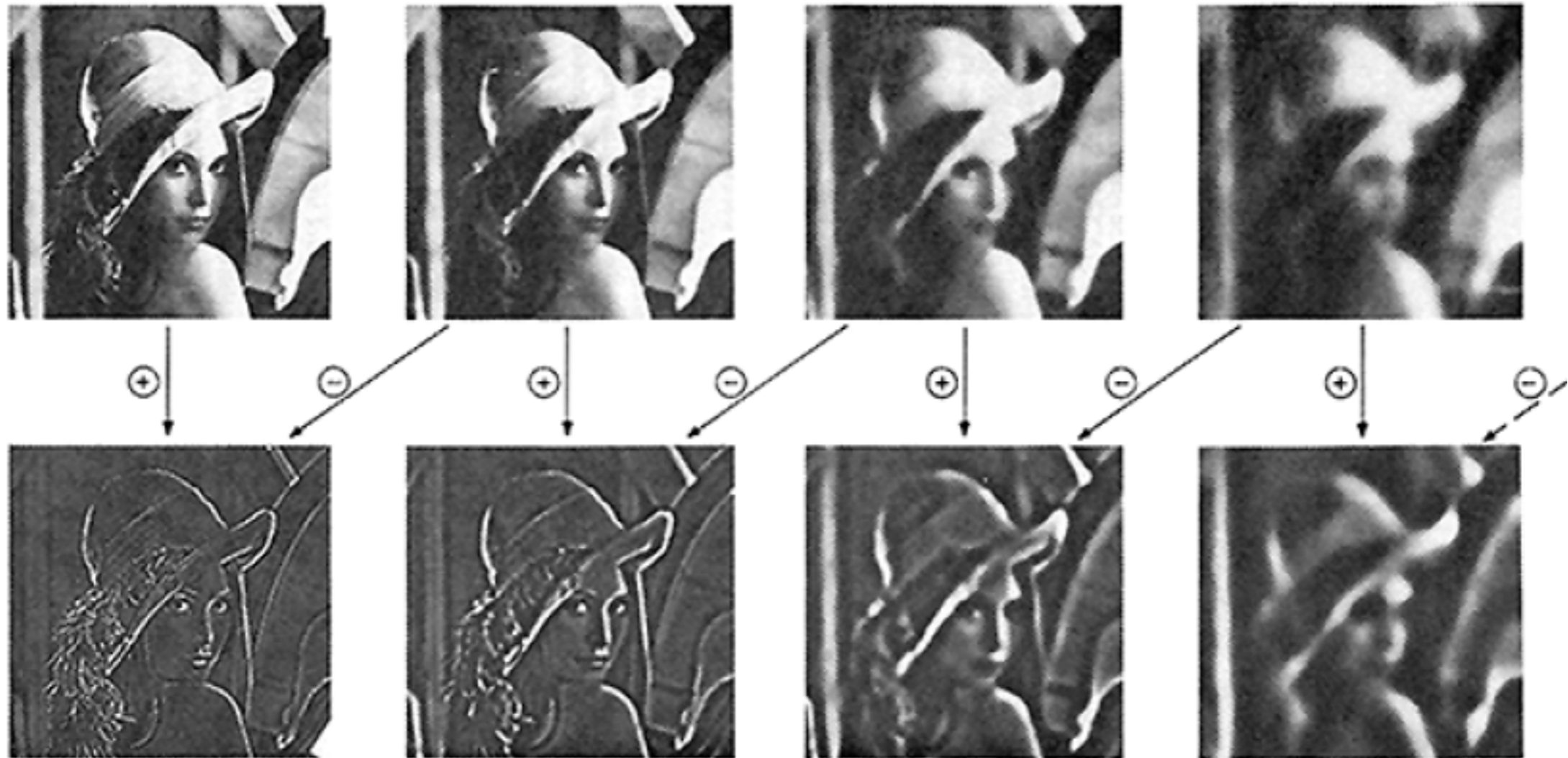
# Why read papers?

To learn about the state-of-the-art

- **To learn about ideas in an area**
- To learn about the community of people in your area
- To understand the trajectory of research
- **To write papers**
- To debate papers in a certain course :)

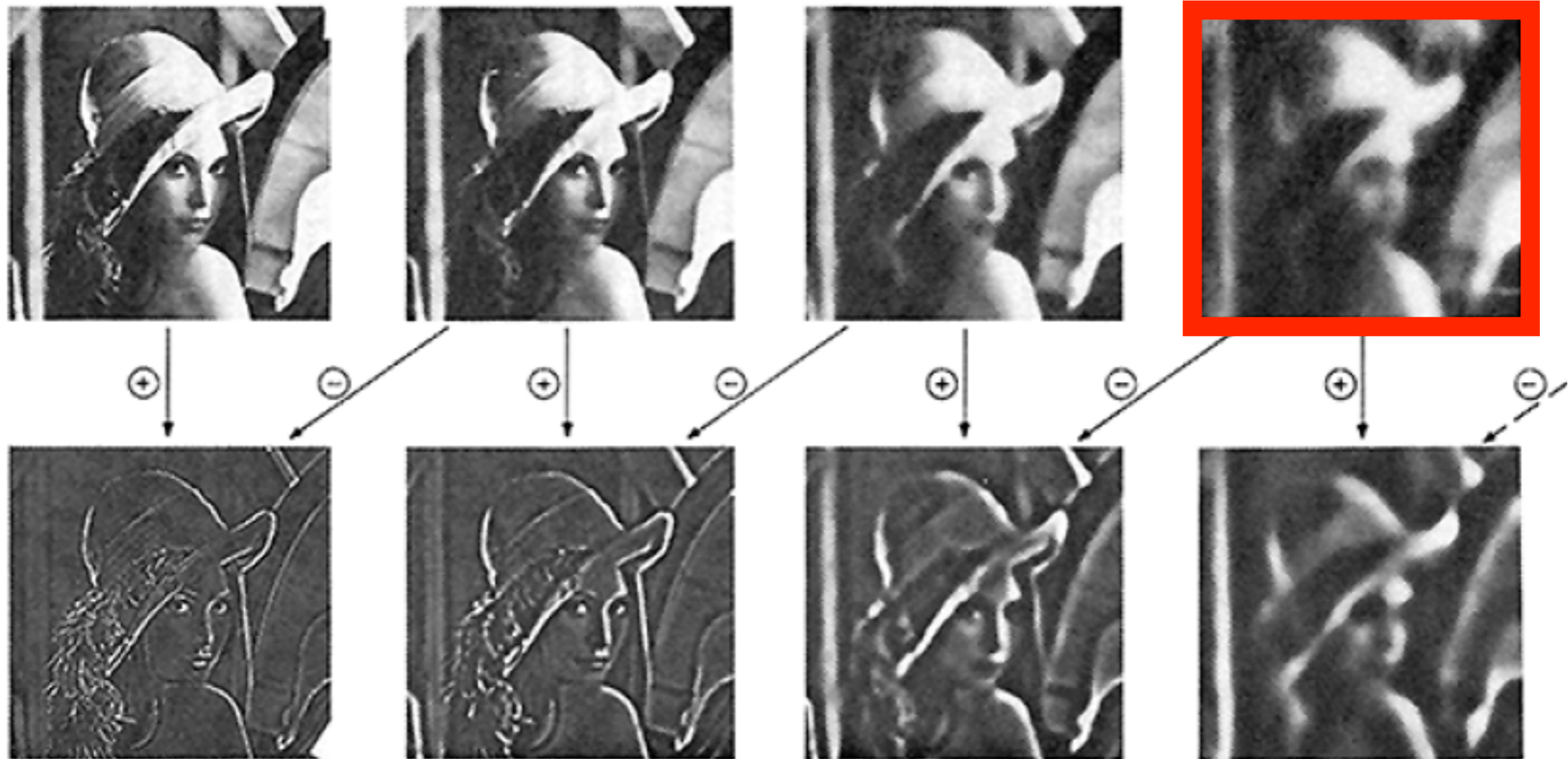
# Coarse-to-Fine Reading

Read the paper in multiple passes



# Coarse Reading

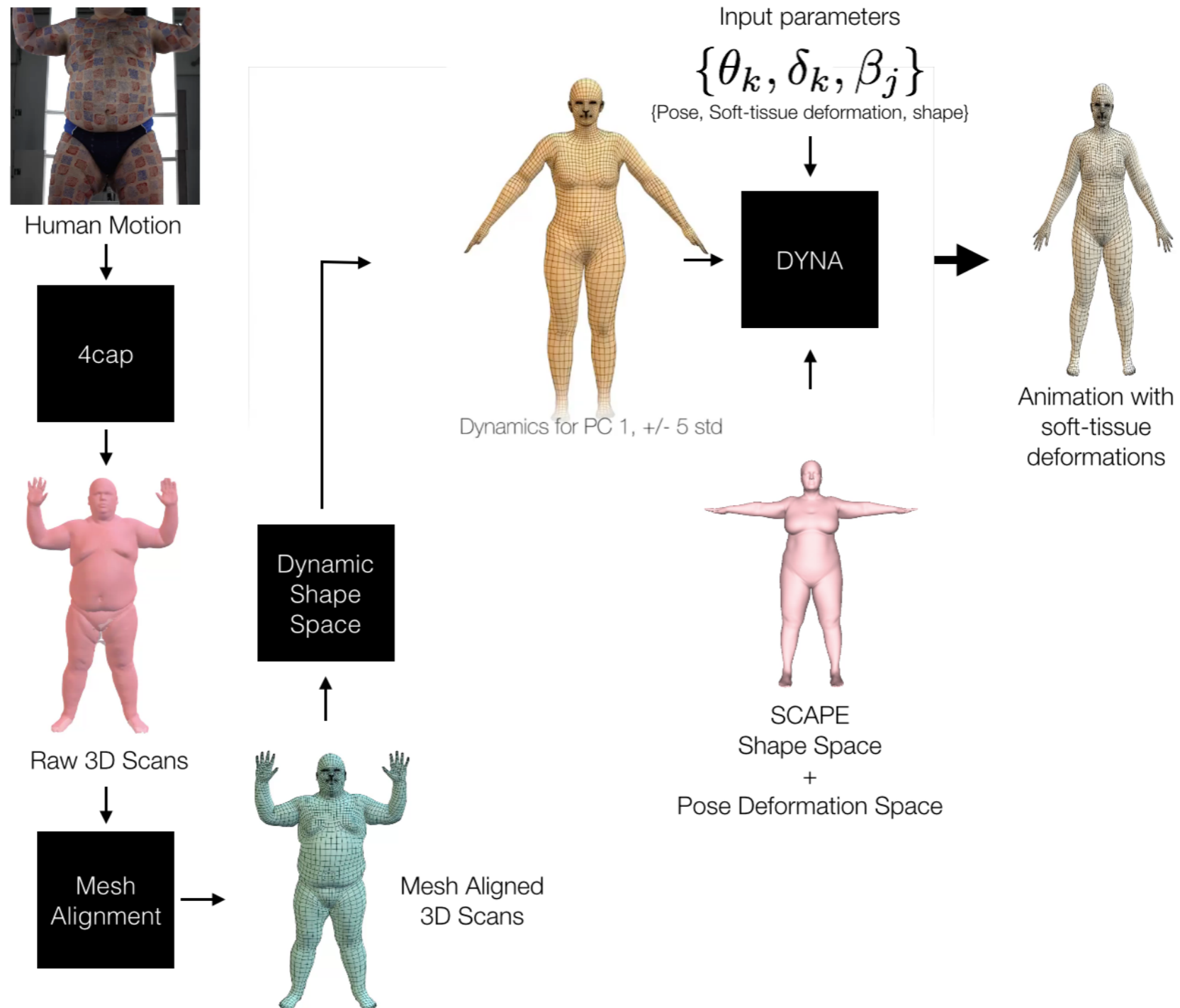
Blackboxing\*



\*[credit for term: Kayvon Fatahalian]

# Coarse Reading

## Blackboxing



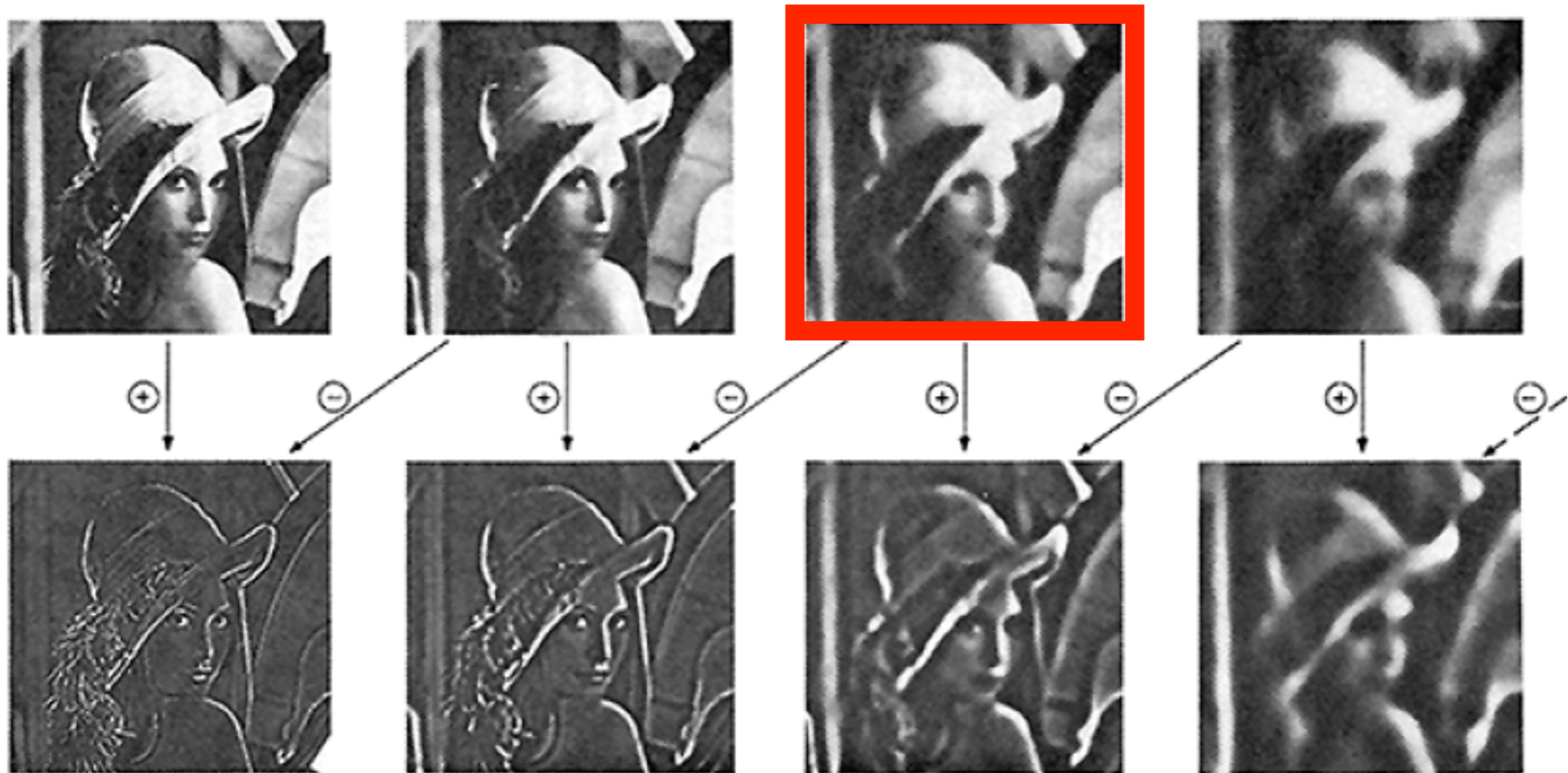
# Coarse Reading

## Blackboxing

- **Print the paper. Make notes on the paper.**
- Read the paper quickly the first time (in an hour)
  - Pick up the notation
  - Understand inputs and outputs (blackboxes) of the paper, the sections, etc.
  - Note all the claims of novelty in the paper
- If I don't know something, I quickly look it up; if I still don't get it, I move on.
- Most authors write as if the readers already understands the paper as well as they do. This heuristic gives you an approximation of that understanding.
- In well-written papers, the figures and captions tell you how to blackbox the paper. Well-produced SIGGRAPH movies help with blackboxing.

# Fine Reading

Can I code the idea?





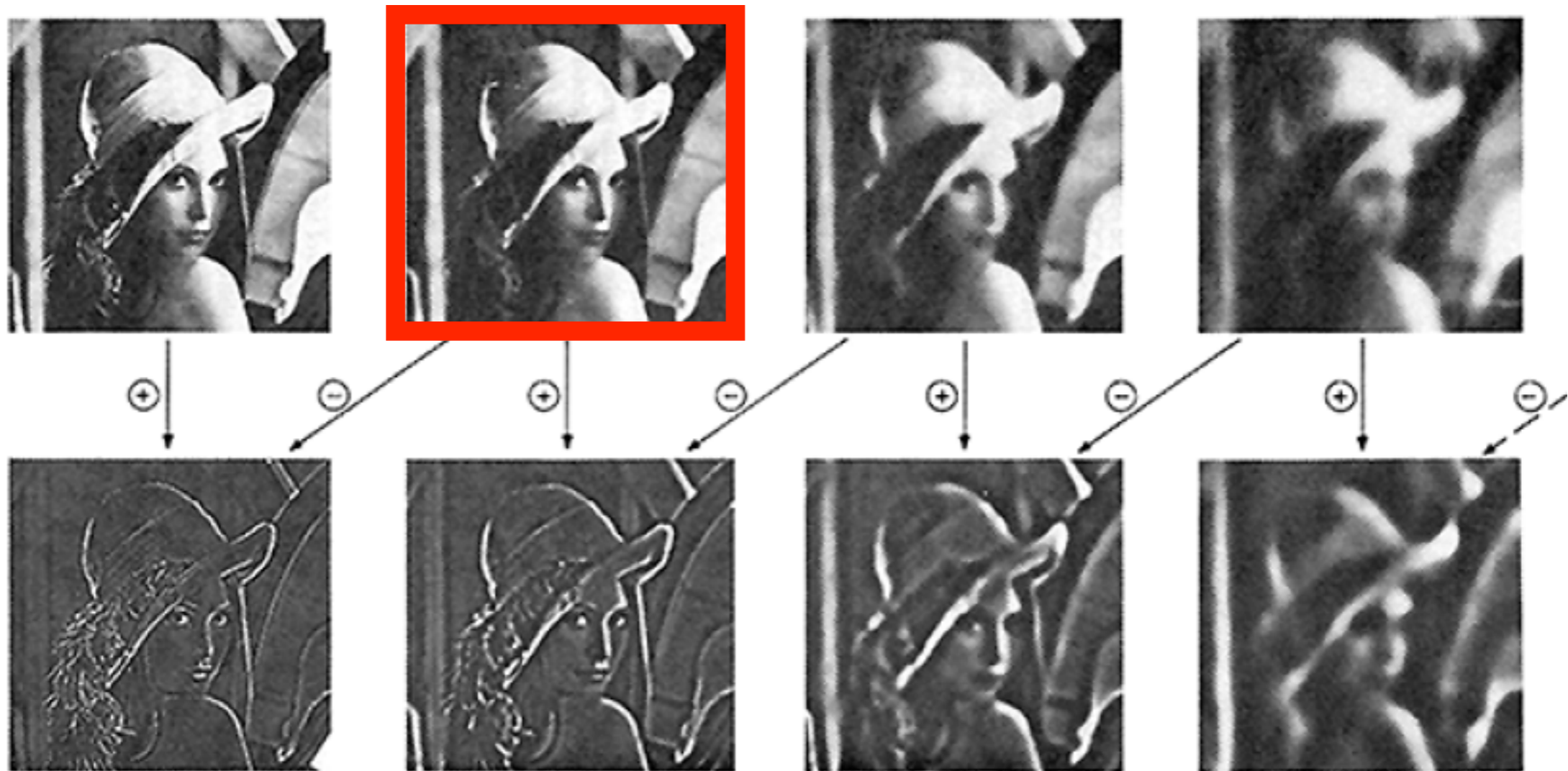
# Understand Everything in the Paper

## *Everything*

- Read the paper a second time much more carefully, working out what each equation means.
- Do not move until you get each equation well enough to code it. If you're stuck look it up. Discuss it with your labmates. Discuss it with faculty. Discuss it with me.
- Approach the whole paper as you would if you were coding it (sometimes I actually *do* prototype some idea kernels).
- Keep re-reading until you get *everything*.

# Finer Reading

How did the authors come up with the solution?



# Be Critical

Run a simulation in your head of each idea

- Is it original?
- Is it reproducible?
- Did the authors omit any results? Any figures?
- Were all the claims justified?
- Is it likely to inspire future work?
- Are there simpler solutions to the same problem?
- **Did they evaluate the approach thoroughly?**

# Be Constructive

Run a simulation in your head of each idea

- When you get proof, accept it.
- (Almost) all ideas are obvious in retrospective. Was it trivial to come up with the idea prospectively?
- What are the contributions of the paper?
- How much of step forward is it from previous work?

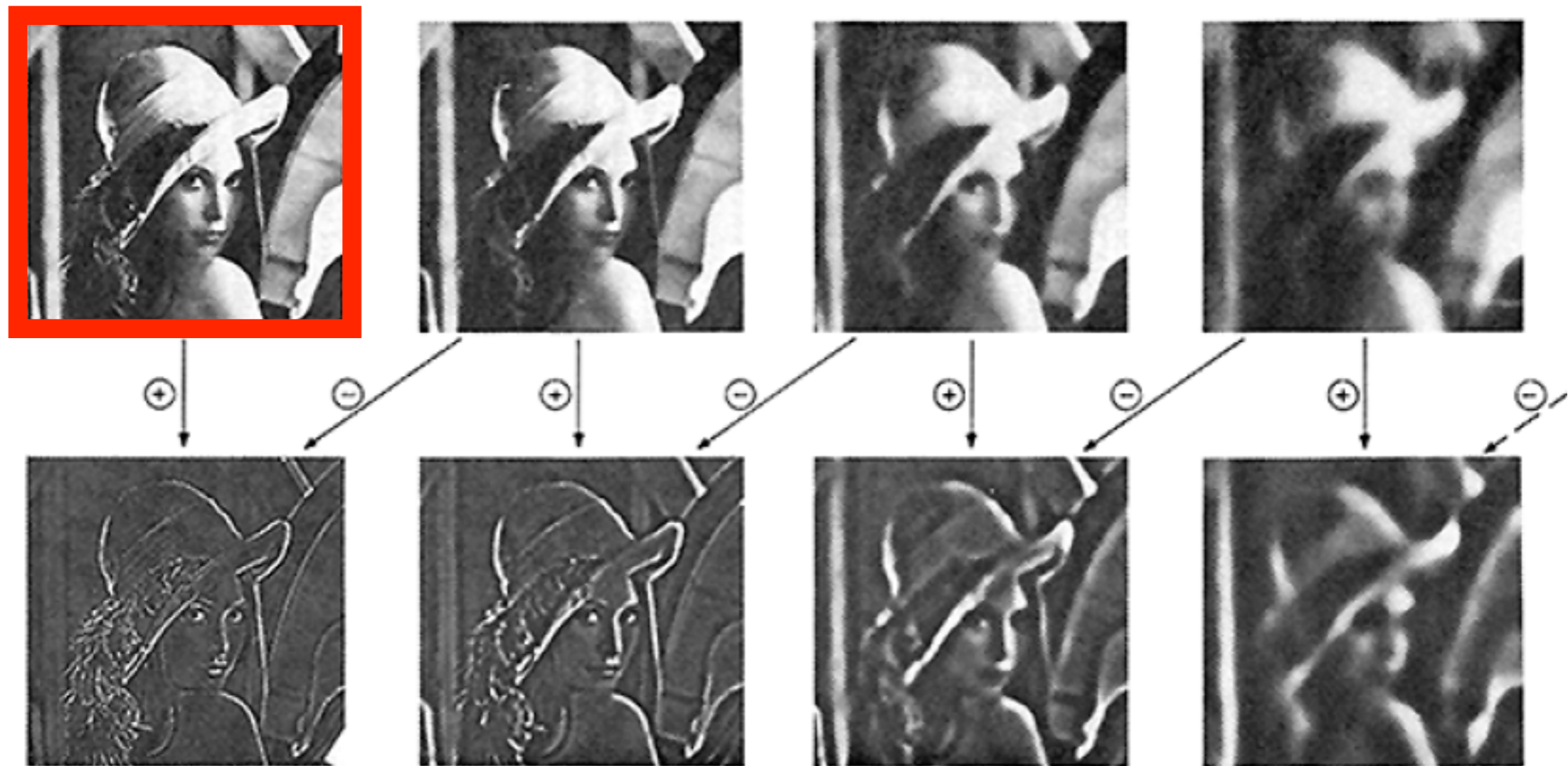
# Multi-pass

Keep reading the paper until you get it

- The trajectory of ideas: read the citations you marked in the first two passes
- Make connections to internal and external ideas
- Create a narrative for the paper
- Think about the solution until it become obvious why they chose to do it the way they did.

# Finest Reading

Why did the authors come up with the question?



Read widely and deeply; Think widely and deeply; “Do” widely and deeply

# Miscellaneous Advice

## Helpful suggestions

- **Print the paper. Makes notes on the paper.**
- Be *very* conscious about what you like/dislike about the paper
- **Live with the paper for a few days.** (Greg Turk)
- Mark interesting citations for future reading.
- **Discuss papers with labmates. Discussion is a form of thinking.**
- Find the easiest access point. Link it to ideas you know about. (Simon Lucey)
- Don't be intimidated by math. (Iain Matthews via Simon Lucey)
- Don't be biased prematurely by the results. (Jason Saragih)
- Read a lot. Build your paper classifier. (Kris Kitani)

Be patient with yourself.  
Reading papers takes time.



# Call to Action!!

- Print and make notes on the paper
- Coarse-to-Fine Reading
  - Coarse: Blackboxing
  - Fine: Think like you're coding the idea
  - Finer: How did the authors come up with the solution?
  - Finest: Why did the authors ask this question?
- Read, read, read: build a foundation of ideas
- Develop rapid-reading skills: connecting to ideas you already have.
- Be patient with yourself: Reading a paper takes time.

# Science and History

Newspapers are the first rough draft of history...

Research papers are the first rough draft of science...

... but we can directly *test* truth in ideas