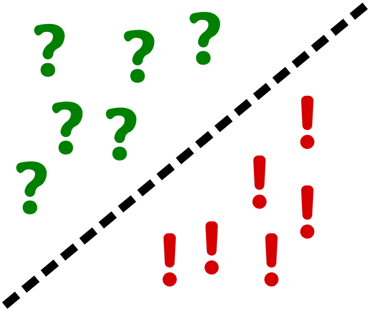
Metascience for ML

Preaching to the Choir

June 20, 2025



Jan van Gemert

Whoami: Jan van Gemert

Assoc. prof; head Computer Vision lab @ PRB

Two main research themes:

1. Fundamental empirical understanding-based deep learning research; (to)
2. Find & evaluate powerful yet flexible physical priors for data-efficient visual recognition AI.

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I signed up because...
I want to share my vision and learn from others how they do ML research.

Metascience for Machine Learning is...
A method for doing research.

I would like to contribute to metascience for ML by...
My own incomplete work-in-progress methodology :).

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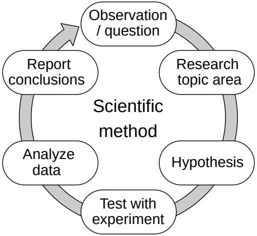
Mine is not "*The* Way"; it's "A Way".

The scientific method[1] in times of deep learning

Deep learning powers AI; yet as a scientific field has growing pains[2,3,4]



- Improvement-driven (large compute/data);
- Trial and error (graduate student descent)
- Opportunistic (career driven);
- Reviewer damage (Benchmark fetish; Mathiness);
- Confusing speculation with explanation
- Not identifying the reasons for empirical gains.

[1]: https://en.wikipedia.org/wiki/Scientific_method

[2]: Lipton et al. "Troubling Trends in Machine Learning Scholarship", 2018.

[3]: Sculley, David, et al. "Winner's curse? On pace, progress, and empirical rigor." 2018.

[4]: Togelius, Julian, et al. "Choose your weapon: Survival strategies for depressed AI academics" Proc. of the IEEE (2024).

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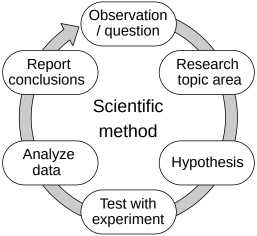

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- ML/DL does not have many empirical theories.

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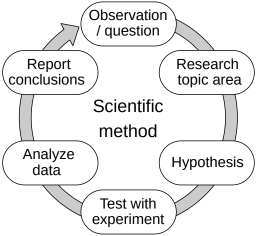

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  ◦ Neural Scaling Laws; ◦ Bias/variance ◦ ML is like physics/neuroscience;
  ◦ Simple axioms explaining intelligence ◦ ...

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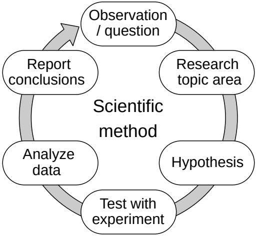

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- Mores in the field: End-to-end learning; 'bold' numbers on common datasets; trail and error; openly sharing code/weights/data; all papers open on ArXiv.

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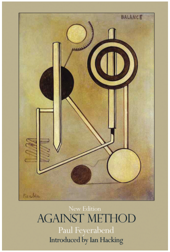
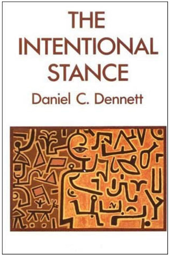
Against method: “*The* Way” vs “A Way”





- There is not "one way" to do science. Science moves on, *despite* the methodology used[5].

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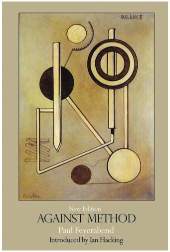

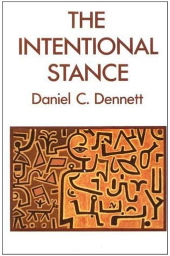

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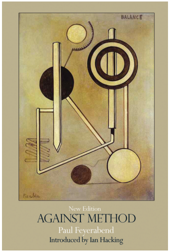

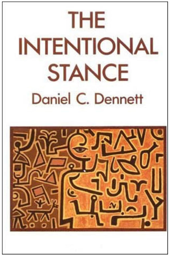

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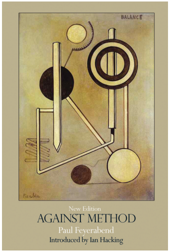

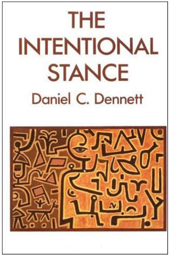

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Let people do research however they want (including yourself).

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My hero: Dr. Elizabeth Bik, science sleuth

1: ML misconduct: tune on the testset; cherry picking; plagiarism, overclaiming; isn't as bad as the explict manipulation as done here.

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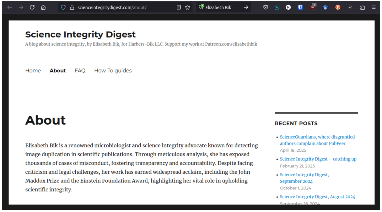

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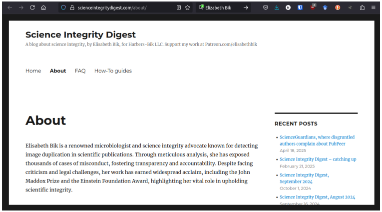

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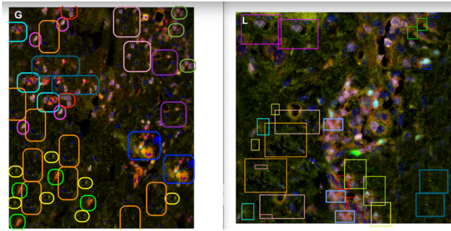

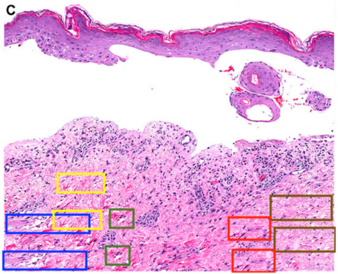

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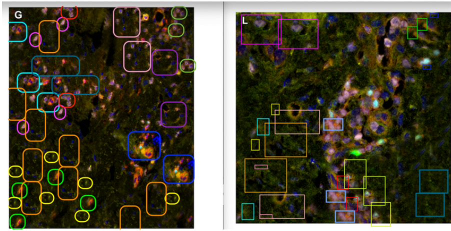

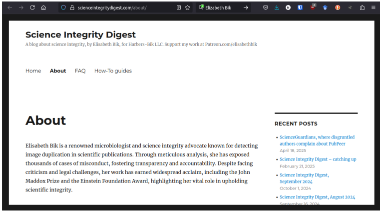
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Elizabeth Bik

Science Integrity Digest

A blog about science integrity, by Elisabeth Bik, for Harbers-Bik LLC. Support my work at Patreon.com/elisabethbik

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About

Elisabeth Bik is a renowned microbiologist and science integrity advocate known for detecting image duplication in scientific publications. Through meticulous analysis, she has exposed thousands of cases of misconduct, fostering transparency and accountability. Despite facing criticism and legal challenges, her work has earned widespread acclaim, including the John Maddox Prize and the Einstein Foundation Award, highlighting her vital role in upholding scientific integrity.

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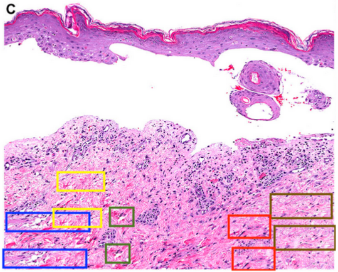

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Doesn't (only) preach "Don't do fraud; it's bad"[1]; she does the work.

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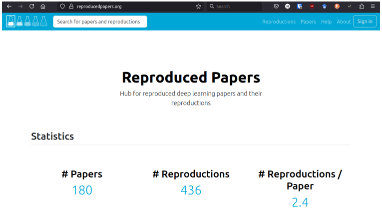
My work for fundamental empirical research in ML/DL



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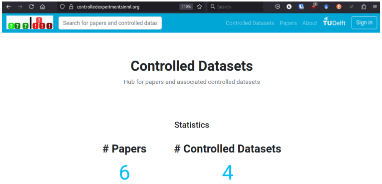

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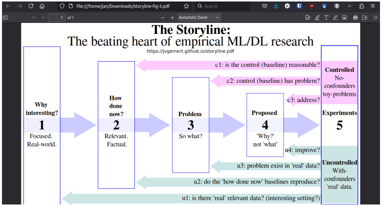

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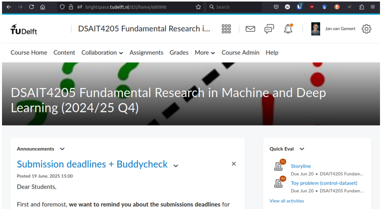

MSc course

The last slide: end on a high note.

I don’t believe:

- No single way to do science;
- No “*too crisp definition squabbling*” (we can’t even define a chair).
- No preaching; let system builders build systems.

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I believe:

- ML/DL work is open as a field, openly sharing code, weights, papers.
- ML/DL misconduct (tune on the testset; cherry picking; plagiarism, overclaiming) is not as bad as elsewhere; limited direct fraud
- that the scientific method will correct things eventually.
- in "Be and let Be". Let others do research their own way.
- in *doing*: help the ones that want to be helped.
- in moving constructively forward, ie: Do Something: my methodological development: reproducedpapers.org; controlledexperimentsinml.org; research guidelines; MSc course, this workshop, etc... (?)