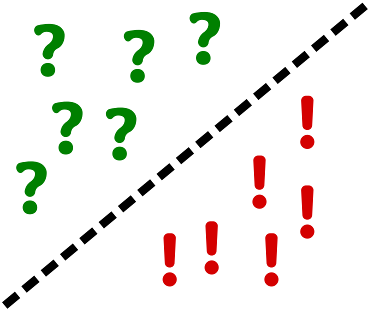
Metascience for ML

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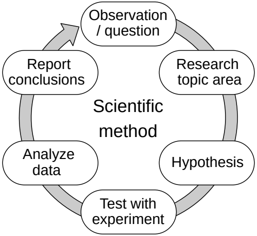
Mine is not "*The* Way"; it's "A Way".

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.

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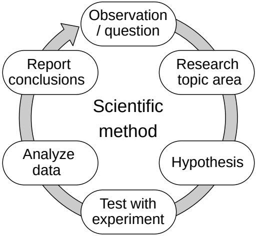

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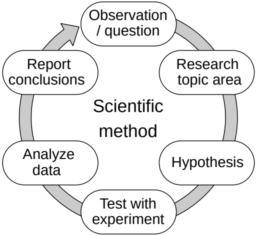

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  ◦ Neural Scaling Laws; ◦ Bias/variance ◦ ML is like physics/neuroscience;
  ◦ Simple axioms explaining intelligence ◦ ...

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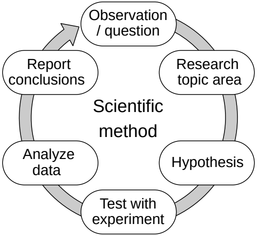

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- Mores in the field: End-to-end learning; 'bold' numbers on common datasets; trail and error; openly sharing code/weights/data; all papers open on ArXiv.

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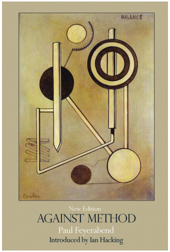
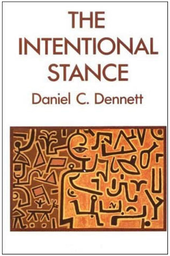
Against method: "*The* Way" vs "A Way"





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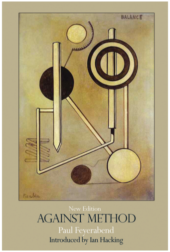

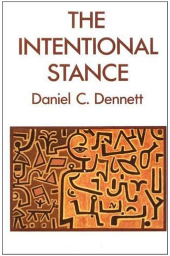

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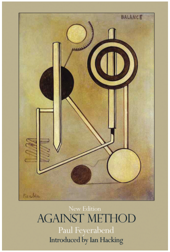

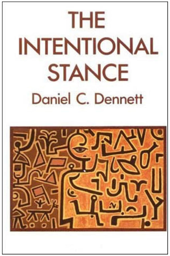

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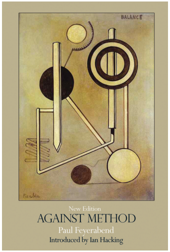

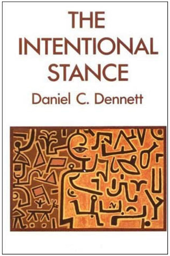

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Let people do research however they want (including yourself).

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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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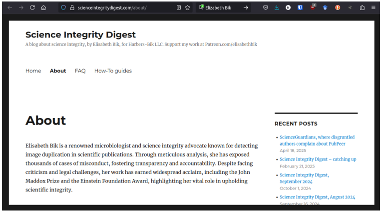

scienceintegritydigest.com

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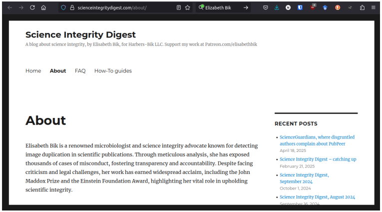

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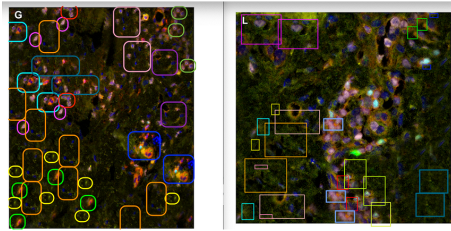

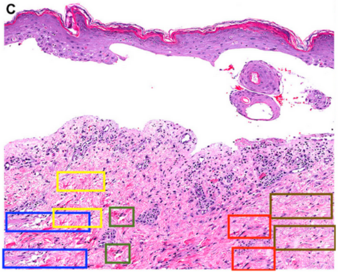

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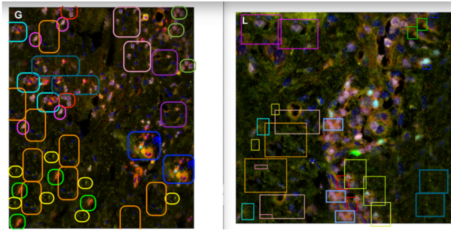

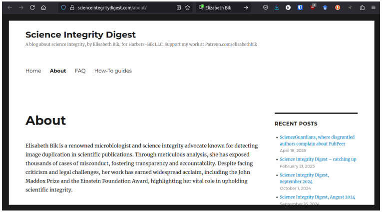

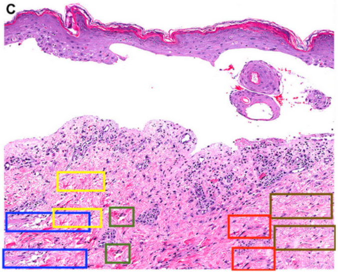

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Doesn't (only) preach "Don't do fraud; it's bad"[1]; she does the work.

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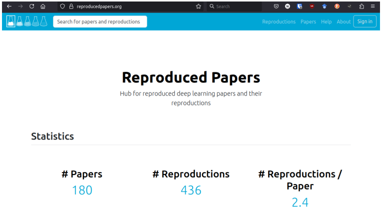
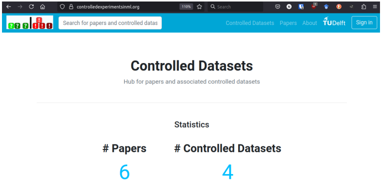
My work for fundamental empirical research in ML/DL



reproducedpapers.org



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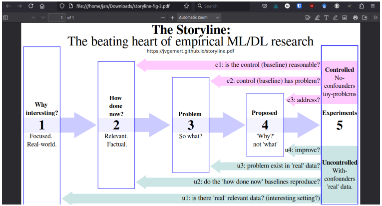
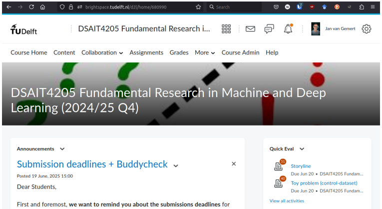


Online research guidelines



MSc course

The last slide: end on a high note.

I don't believe:

- No single way to do science;
- No "*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: Methodological development: reproducedpapers.org; controlledexperimentsinml.org; research guidelines; MSc course, this workshop, etc... (?)