Deep Learning & Applied AI

Introduction

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SAPIENZA
UNIVERSITÀ DI ROMA

2nd semester a.y. 2020/2021 · February 24, 2021

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- **Assistants:** Dr. Luca Moschella and Dr. Antonio Norelli
  Coding sessions, project support, technicalities

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- **Office Hours:** Raise an issue on github! (see next slide)
- **Official website:** https://erodola.github.io/DLAI-s2-2021/
  Check frequently for news and material (code, papers, ...)!

Repository & Issues

The course is hosted on Github at the url:

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Webpage and repository are your main source of information, and replace completely the need for a mailing list. Check them often!

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- The course is challenging

Being proficient with Keras, or getting a good grade at other ML courses, will not guarantee success.

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- **Postpone study**
  New lectures usually assume knowledge from the previous lectures.

Recipe for success

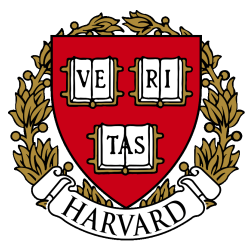
Try to enjoy the course!

Take this as an opportunity to learn in depth.

Ask questions when in doubt.

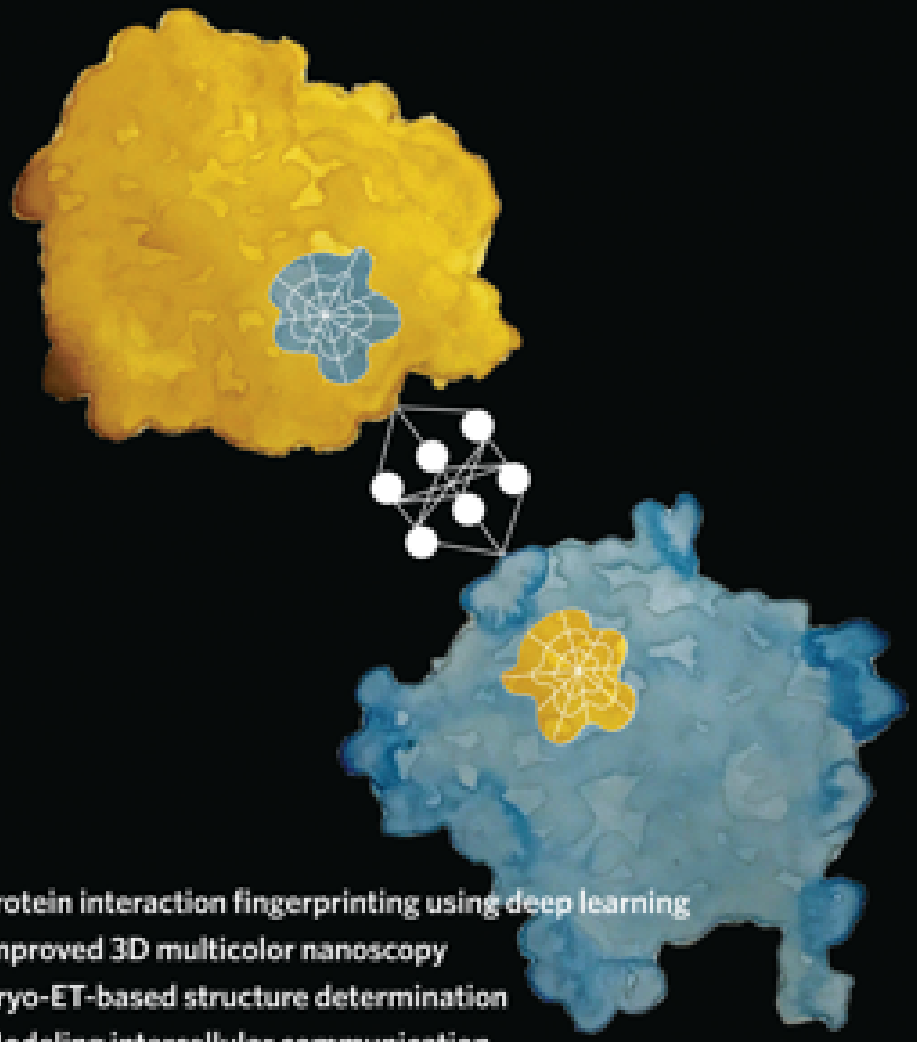
Who am I?

- Had research positions at U Tokyo, TU Munich, U Lugano and visiting positions at Harvard, Stanford, Ecole polytechnique, Technion among others
- Research: digital geometry processing, geometric deep learning
- Team: ∼20 members from physics, engineering, computer science **GLADIA** group of Geometry, Learning and AI
- If you have ideas, approach me for projects and theses




nature.com/nmeth February 2020 Vol. 17 No. 2

nature methods



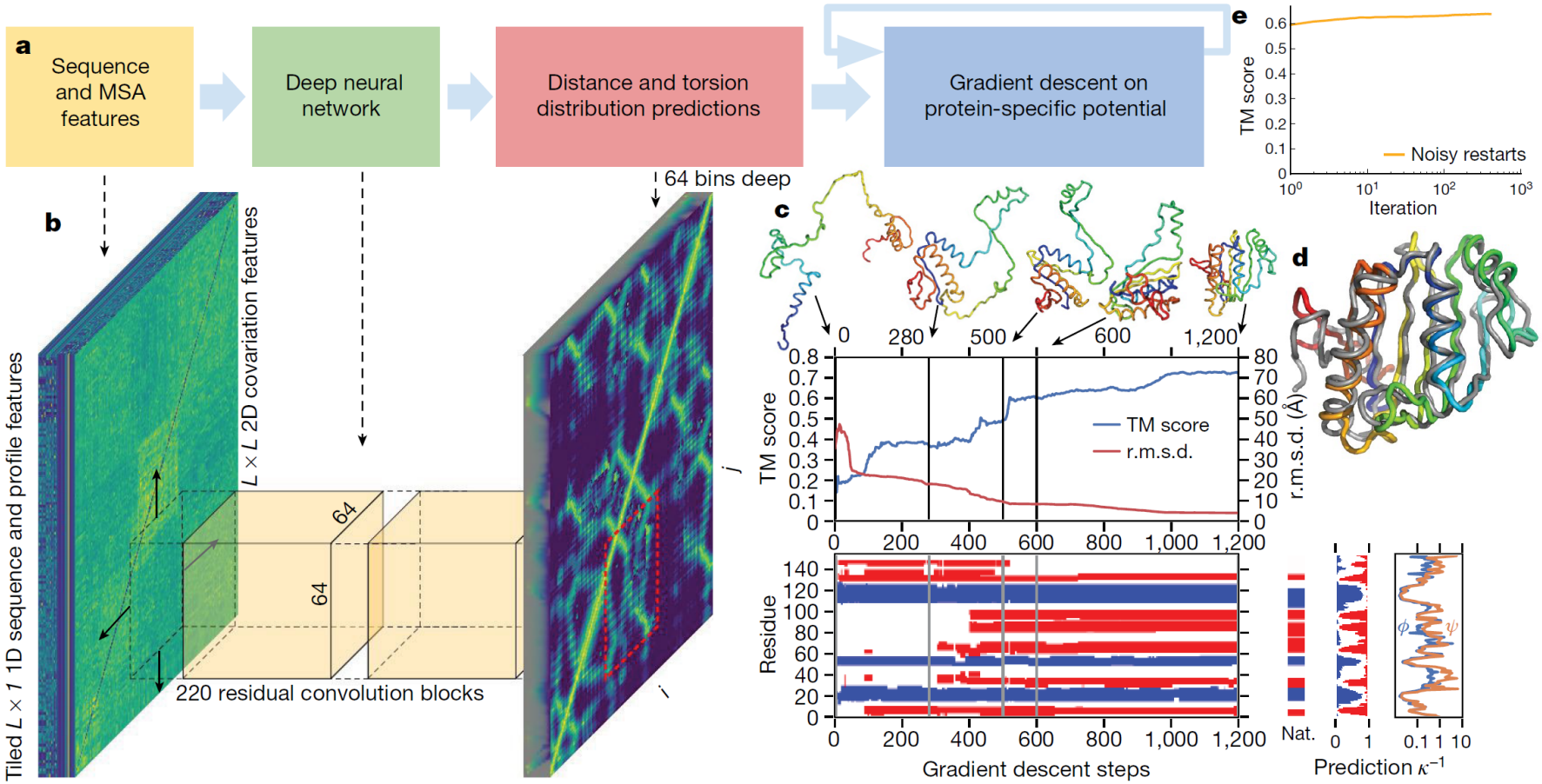
Protein interaction fingerprinting using deep learning

Improved 3D multicolor nanoscopy

Cryo-ET-based structure determination

Modeling intercellular communication

The Bioconductor project for single-cell analysis



https://deepmind.com/research/case-studies/alphafold

Pre-requisites and reading material

No official textbook.

Specific references will be given throughout the course in the form of book chapters and scientific articles.

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Pre-requisites:

- **Programming fundamentals**. We will use Python
- Welcome (not mandatory): linear algebra, calculus

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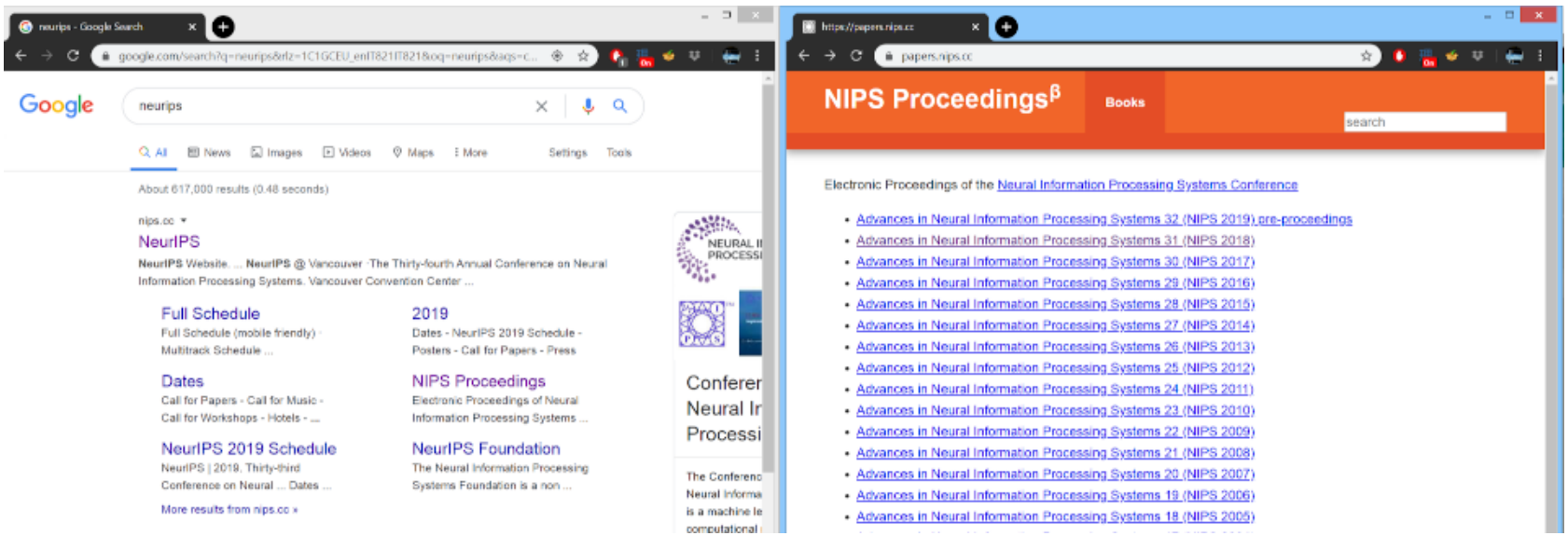
Main source: specialized conferences and journals:

NeurIPS, ICML, ICLR, JMLR, CVPR, etc.



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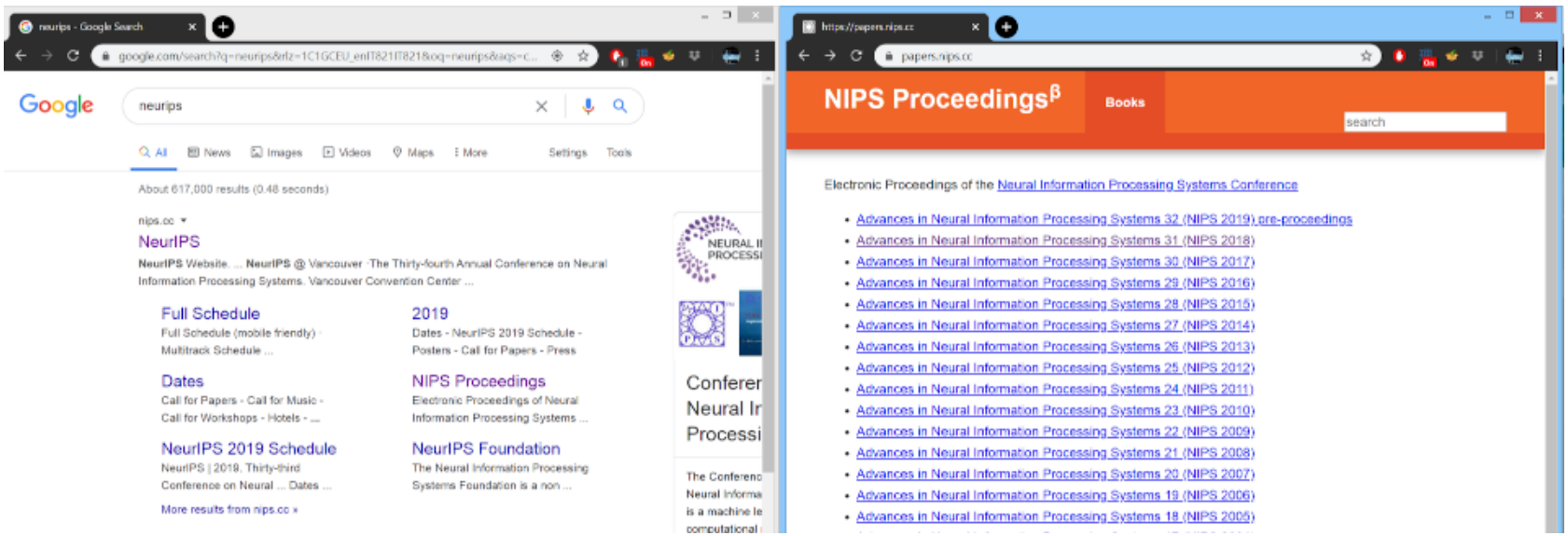

Applications: we'll mostly illustrate things in the areas of computer vision, geometry processing, graphics, social networks, biochemistry.

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In class, be prepared:

- Download/print the slides beforehand
- Take notes: not everything will be on the slides
- Bring your laptop: we'll do live coding sessions

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(if you study)

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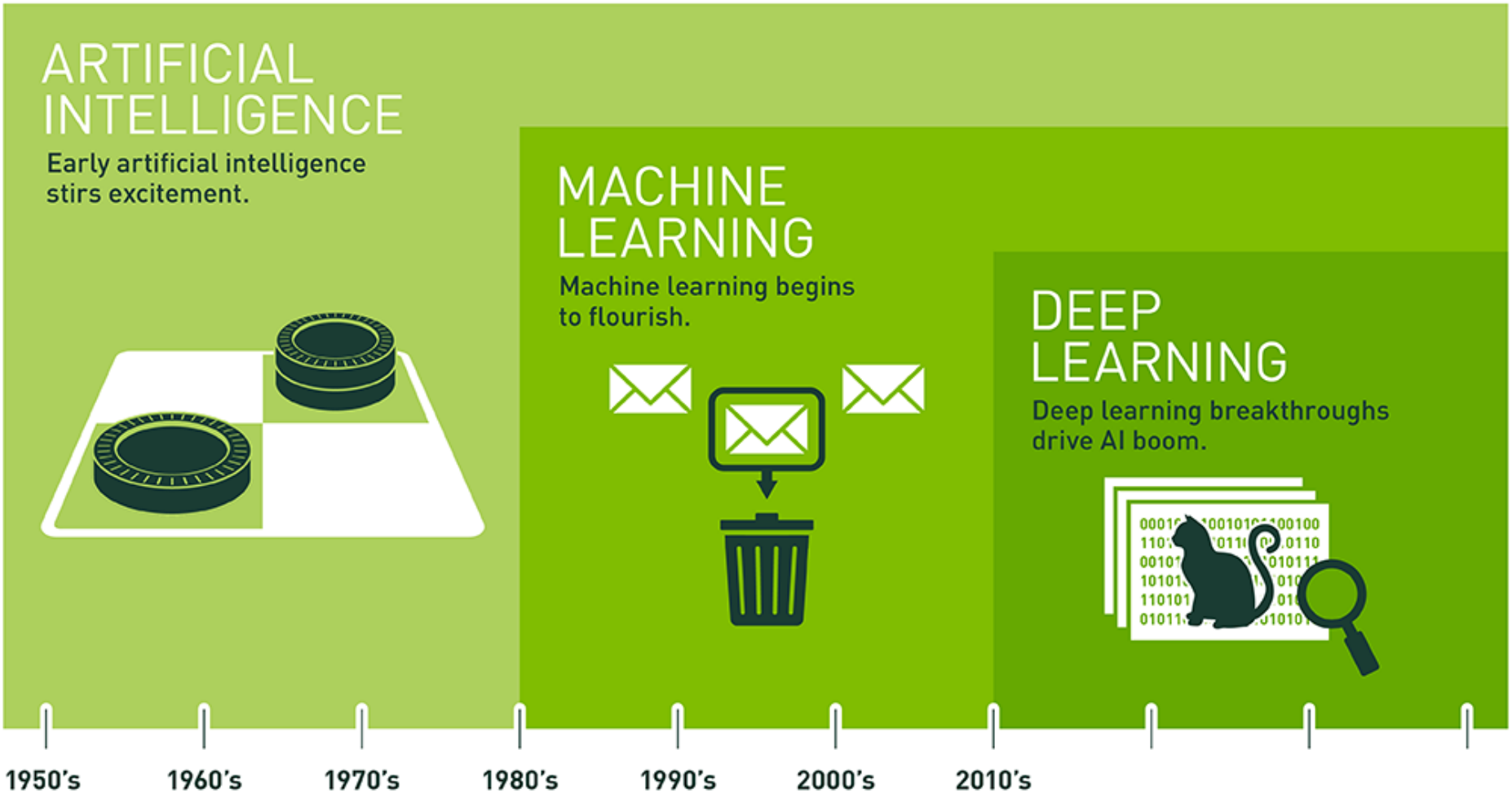
- You will get practical development expertise on applied problems

Mathematical tools

- Linear algebra
- Calculus
- Optimization
- Discrete mathematics
- Probability & statistics
- Metric and differential geometry

This is not an easy course, but results will speak for themselves.

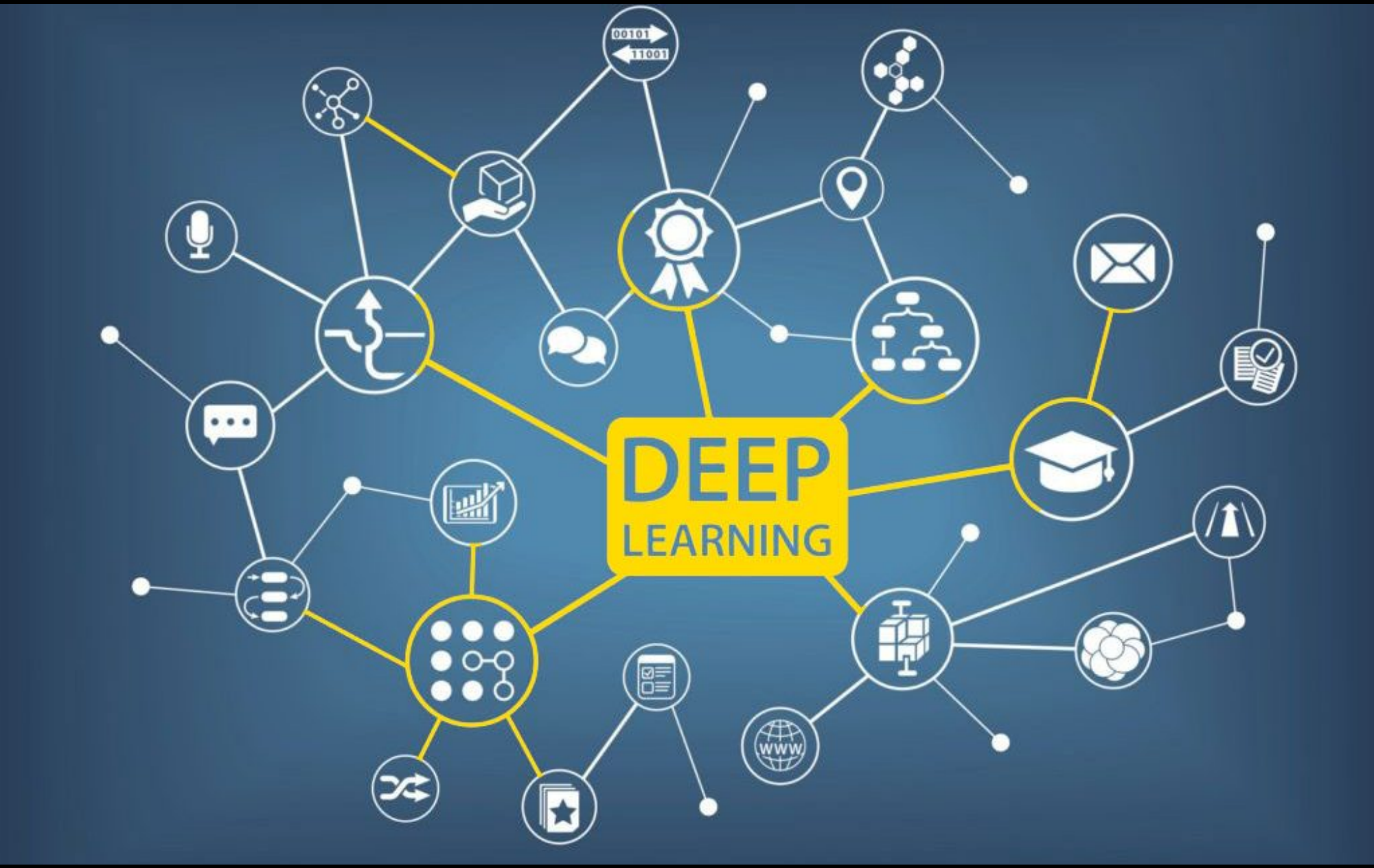
We will have to develop ways to evaluate, visualize, and quantify what we are doing. Going blind-folded and regarding learning models as black boxes will not bring us very far!



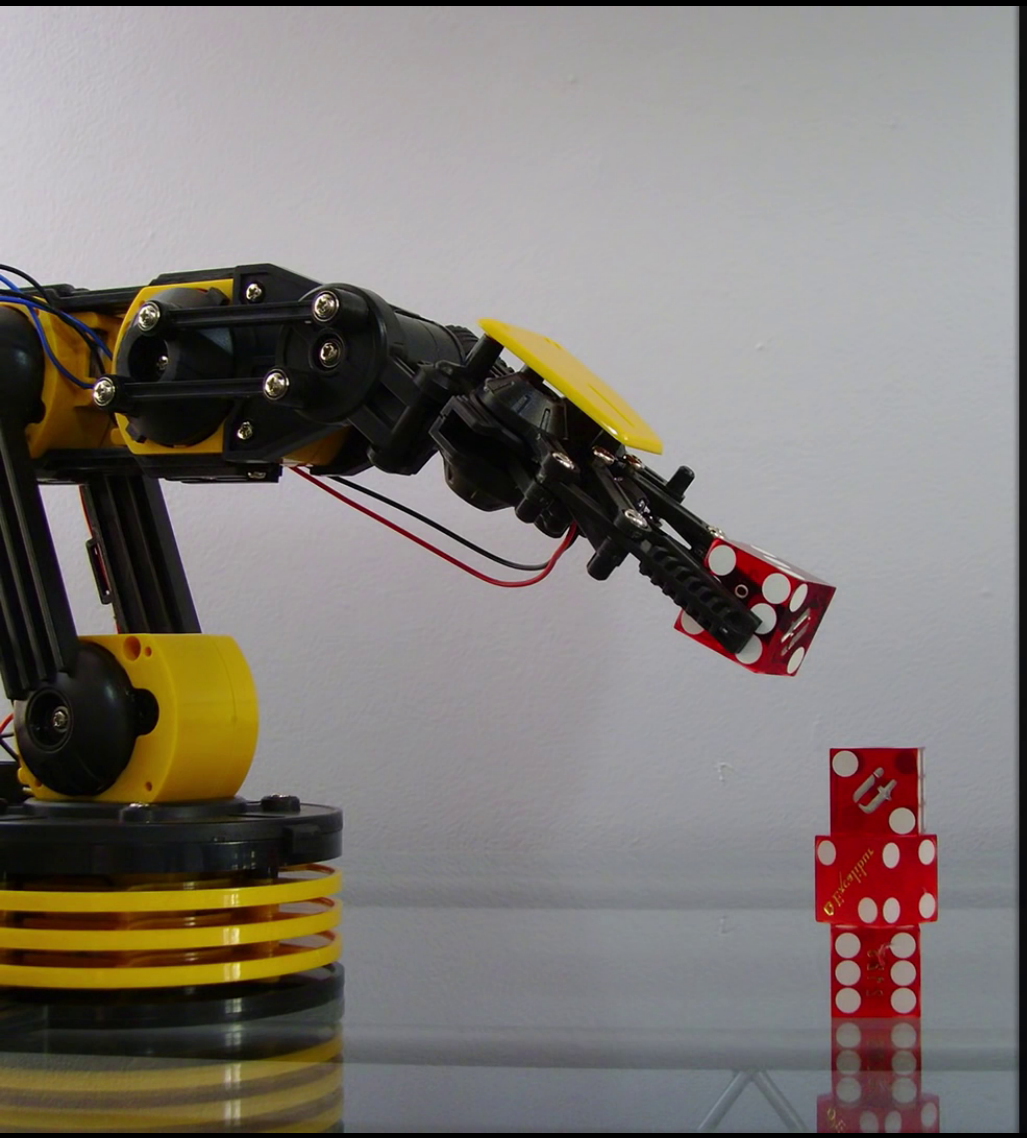
Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

Image: Michael Copeland, NVIDIA

Deep learning is everywhere



Showcase



TWO MINUTE PAPERS

WITH KÁROLY ZSOLNAI-FEHÉR (KZF)

10 MORE COOL DEEP LEARNING APPLICATIONS

Disclaimer: I was not part of this research project,
I am merely providing commentary on this.