

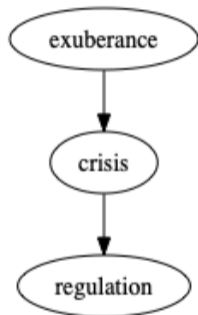
Artificial Intelligence, Risk and Discrete Geometry

Dr. Paul Larsen

April 14, 2022

Risk, Regulation and Artificial Intelligence¹

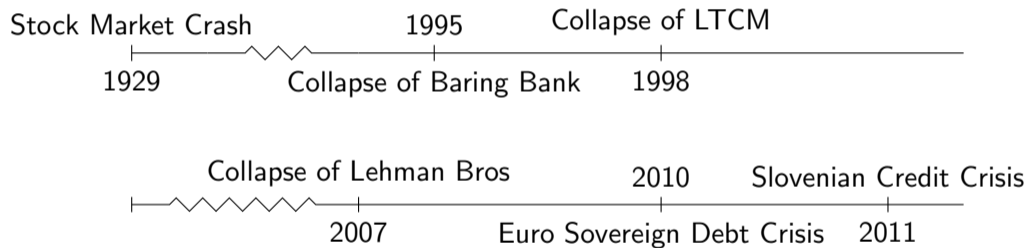
... in one diagram



¹What about discrete geometry? Just wait ... it shows up soon and keeps reappearing 

What is Risk Regulation?

A brief history of financial disaster



What is Risk Regulation?

A cheeky guide to financial services risk types

The risk of losing money due to ...

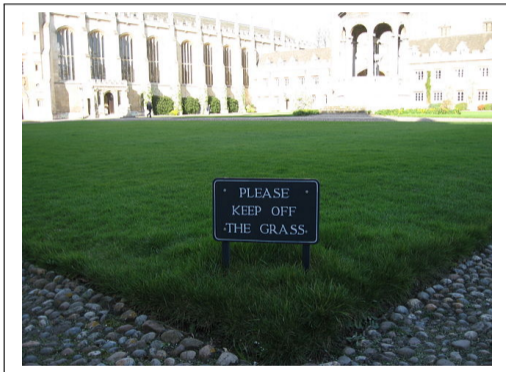
- Credit: counter-party default
- Market: market movements
- Operational: something going wrong that shouldn't
- Liquidity: funding mismatches
- Insurance: unexpected loss of premiums or increase of claims

...and the regulation that results from disasters big and small

Basil Framework (banking), Solvency II (insurance), The AI Act (EU), IT Requirements for German Asset Managers

What is AI?

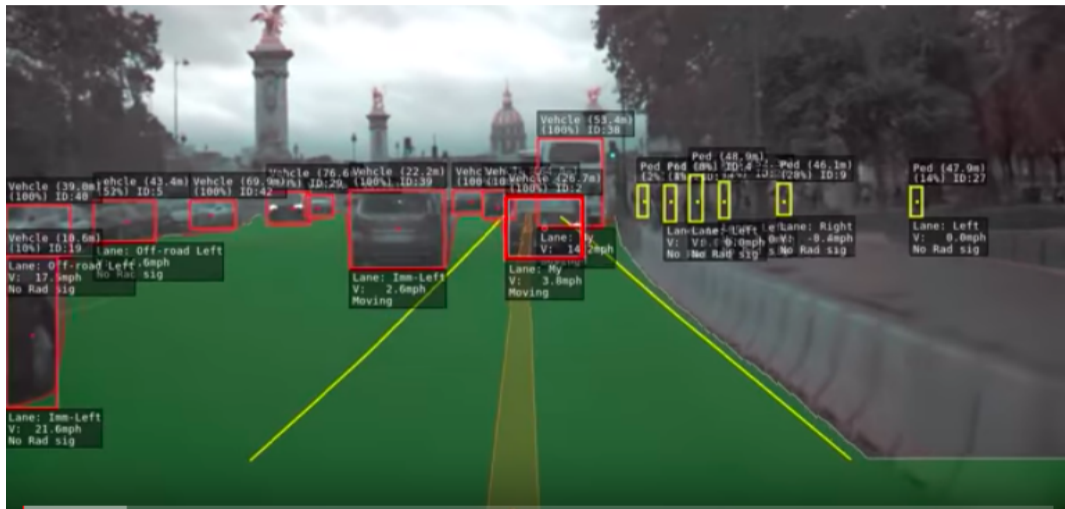
Humans are amazing at navigating a world that does not make sense



Artificial Intelligence Does Not Exist

What is AI?

Artificial Intelligence does not exist, yet ...



Source: [YouTube: greentheonly, Paris streets in the eyes of Tesla Autopilot](#)

What is AI?

Artificial Intelligence does not exist, yet ...

Google Duplex: An AI System for Accomplishing Real-World Tasks Over the Phone

Tuesday, May 8, 2018

Posted by Yaniv Leviathan, Principal Engineer and Yossi Matias, Vice President, Engineering, Google

A long-standing goal of human-computer interaction has been to enable people to have a natural conversation with computers, as they would with each other. In recent years, we have witnessed a revolution in the ability of computers to understand and to generate natural speech, especially with the application of deep neural networks (e.g., [Google voice search](#), [WaveNet](#)). Still, even with today's state of the art systems, it is often frustrating having to talk to stilted computerized voices that don't understand natural language. In particular, automated phone systems are still struggling to recognize simple words and commands. They don't engage in a conversation flow and force the caller to adjust to the system instead of the system adjusting to the caller.

Source: [Google AI Blog](#)

What is AI?

Artificial Intelligence does not exist, yet ...

**MIT
Technology
Review**

Artificial Intelligence

How AlphaZero has rewritten the rules of game play on its own

AI and Risk

AI struggles with context

The scientist named the population, after their distinctive horn, Ovid's Unicorn. These four-horned, silver-white unicorns were previously unknown to science.

Source: <https://www.lesswrong.com/posts/4AHXDwcGab5PhKhHT/humans-who-are-not-concentrating-are-not-general>

AI and Risk

AI struggles with bias

Facial Recognition Is Accurate, if You're a White Guy

By [Steve Lohr](#)

Feb. 9, 2018



Facial recognition technology is improving by leaps and bounds. Some commercial software can now tell the gender of a person in a photograph.

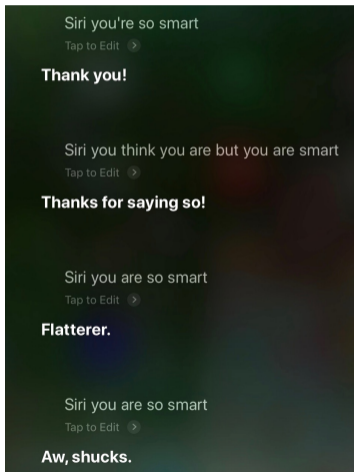
Source: [New York Times](#)

See also: [James Vincent, The Verge, Google 'fixed' its racist algorithm by removing gorillas from its image-labeling tech](#)

AI and Risk

AI Struggles With Human Behavior

Siri Compliments



AI: Where is the crisis?

High risk AI: education

Paragraph 35 of the AI Act (emphasis added):

AI systems used in education or vocational training, notably for determining access or assigning persons to educational and vocational training institutions or to evaluate persons on tests as part of or as a precondition for their education should be considered high-risk.

- FastCompany: AI in admissions, what could go wrong?
- Wired: The algorithms that keep students out of college
- Verge: UK ditches biased algorithm for university admission

AI: Where is the crisis?

High risk AI: access to finance

Paragraph 37 of the AI Act (emphasis added):

*AI systems used to evaluate the credit score or creditworthiness of natural persons should be classified as high-risk AI systems, since they determine those persons **access to financial resources or essential services** such as housing, electricity, and telecommunication services. AI systems used for this purpose may lead to **discrimination** of persons or groups and **perpetuate historical patterns of discrimination**, for example based on racial or ethnic origins, disabilities, age, sexual orientation, or create new forms of discriminatory impacts.*

- Apple Card Controversy: Is its algorithm biased against women?
- General Data Protection Regulation (EU) on automated credit decisions

AI: Where is the crisis?

... and it is still about risk management

Manage risk, don't eliminate it → risk and return

From the introduction of the **AI Act** (emphasis added):

*By improving prediction, optimising operations and resource allocation, and personalising service delivery, the use of artificial intelligence can support **socially and environmentally beneficial outcomes** and provide key competitive advantages to companies and the European economy. Such action is especially needed in high-impact sectors, including climate change, environment and health, the public sector, finance, mobility, home affairs and agriculture. However, the same elements and techniques that power the socio-economic benefits of AI can also bring about **new risks or negative consequences for individuals or the society.***

AI: Where is the crisis?

... and it is still about risk management, II

Manage risk, don't eliminate it → risk and return

From mathematician Cathy O'Neal, author of *Weapons of Math Destruction*, to Slate (emphasis added):

They look at the upside—which is faster, scalable, quick decision-making—and *they ignore the downside*, which is that they're *taking on a lot of risk*.

Workshop topics

1. Introduction
2. Discrete geometry for artificial intelligence and risk
3. Correlation and causation
4. Risk and AI in practice

Workshop format

- For each topic, lecture + tutorial
- Emphasis on examples with data produced via python package **fake-data-for-learning**
- Light on non-mathematical definitions, thanks to

