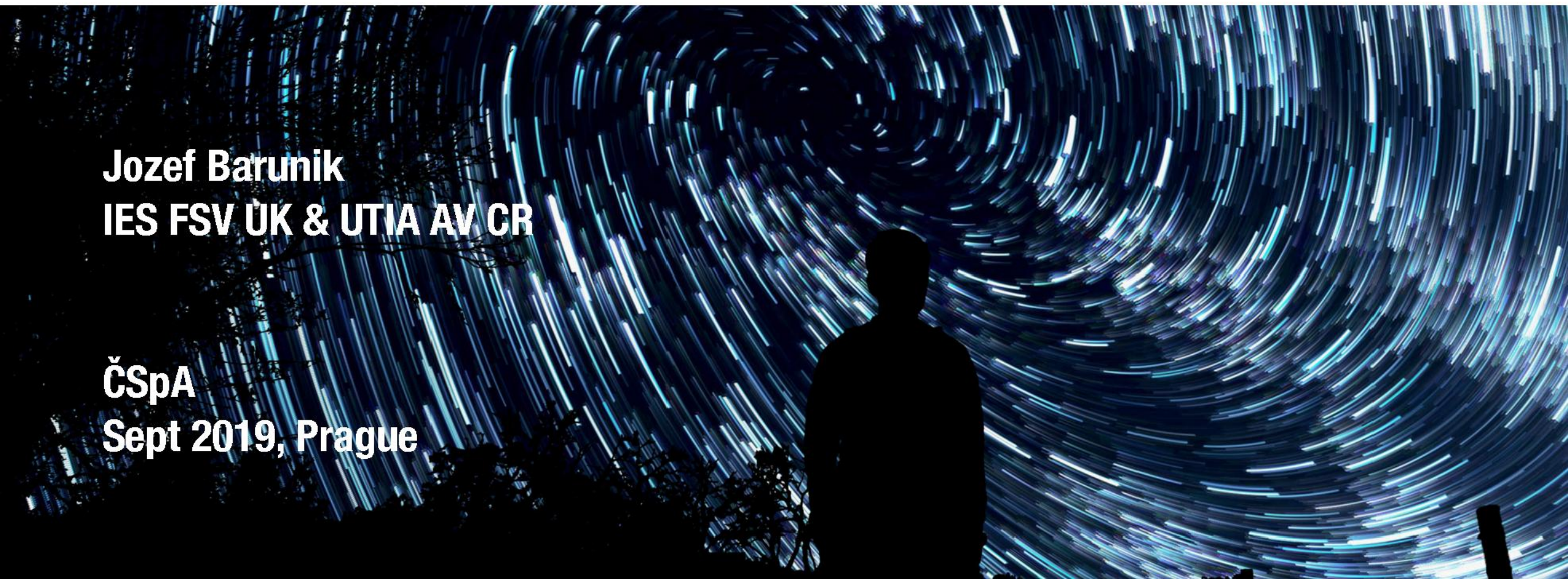


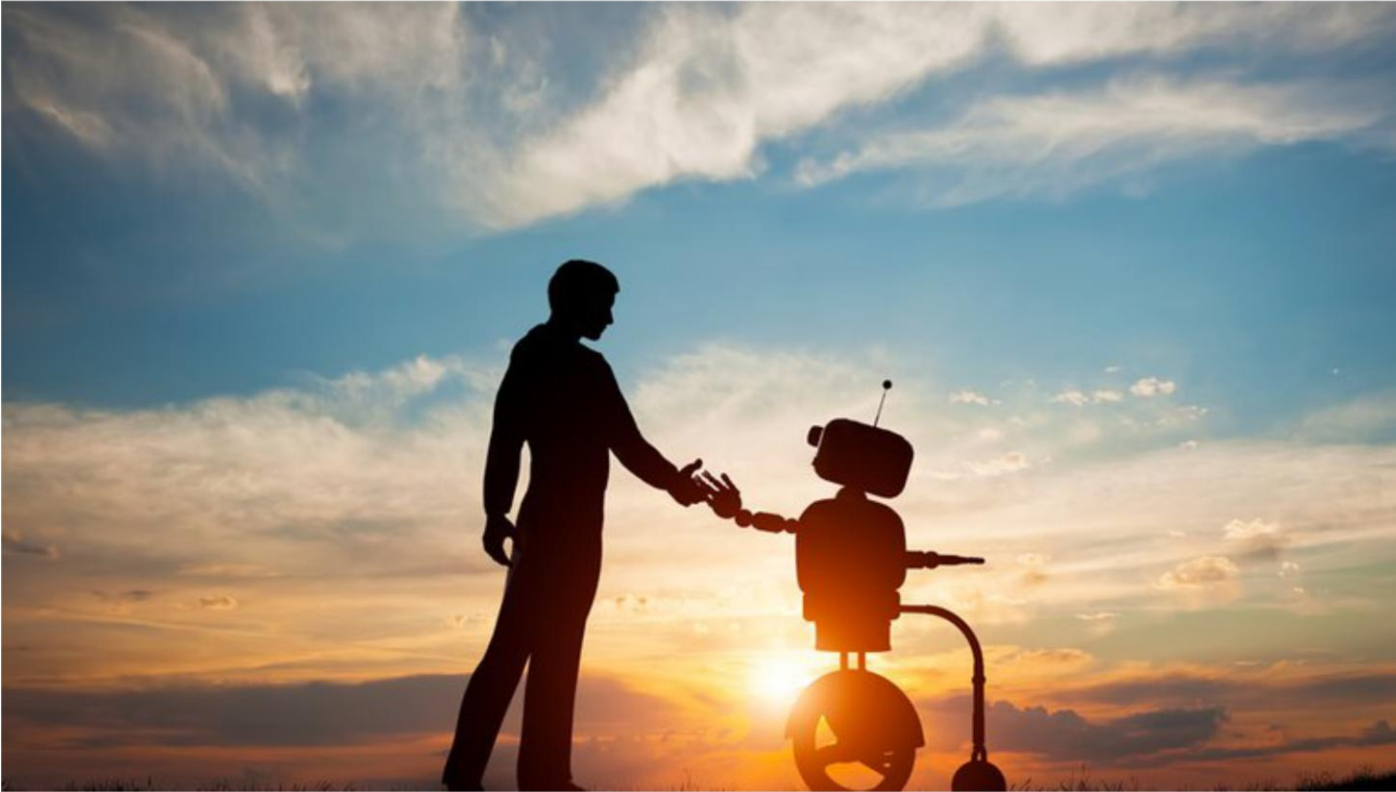
The Socio-Economic Dimension of AI

Jozef Barunik
IES FSV UK & UTIA AV CR

ČSpA
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Prologue



- ❑ We are on the cusp of a digital revolution.
- ❑ Fundamentally changing way we live, work, and communicate.
- ❑ Biggest social and economic changes since the industrial revolution.

Prologue

- ❑ Technology is a driving force in society.
- ❑ Economy and productivity depend on machines taking on an increasing amount of humanity's workload.
- ❑ Artificial Intelligence (AI) has the potential to transform society 10x faster and at 30x the scale of the Industrial Revolution (McKinsey Global Institute forecasts).
- ❑ However, AI already quietly integrated into society.

Prologue

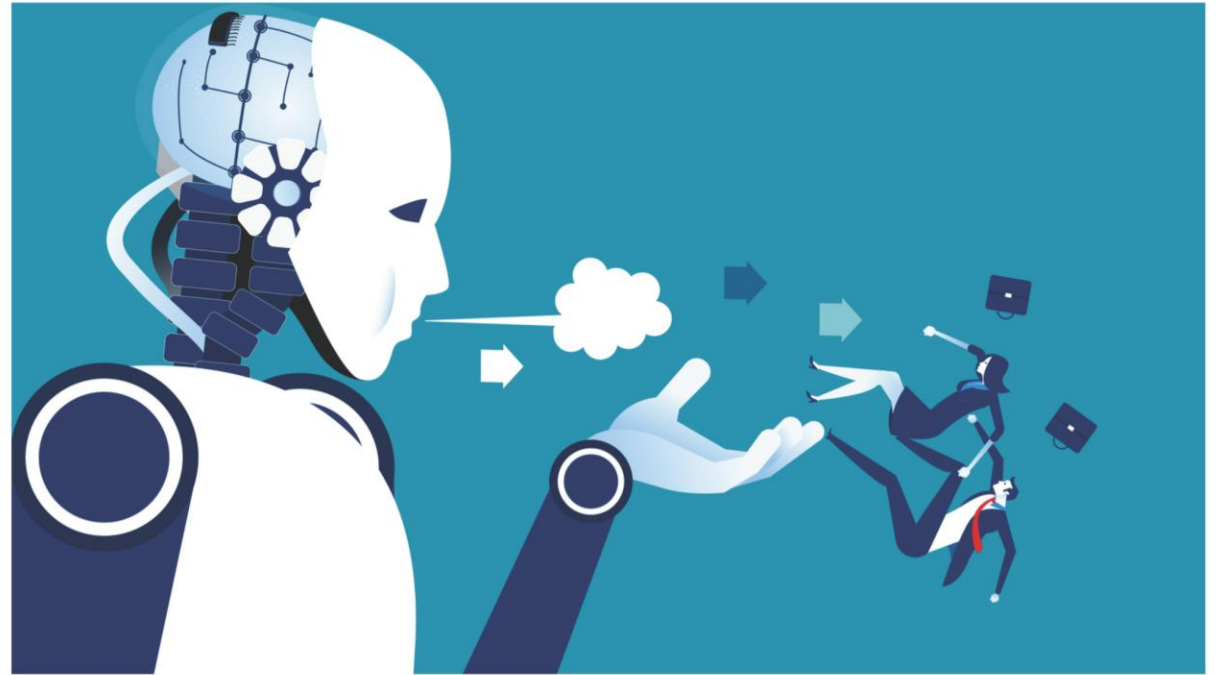
- ❑ AI already making or influencing decisions about hiring, loans, and jail sentences; and aggregating wealth.
- ❑ Quickly augmenting tasks at home (social communication), and work (displace jobs and create new opportunities).
- ❑ Swamp communities with complex issues and a combination of predictable and unanticipated consequences.
- ❑ **AI is not just tech issue, it becomes social studies issue.**

Not a Tech Anymore

- ❑ At its early days AI exceeds human performance and can help society.
- ❑ Accurate computer vision systems, objects detection, or speech recognition are already incredibly influencing our lives.
- ❑ But **AI has potential to transform** education, healthcare, finance, insurance, mobility, energy and has wider impact on **society**.
- ❑ Main challenge we face is to ensure benefits are widely distributed.

Unjustified Worries?

- ❑ Will machines replace human beings?
- ❑ Are we all going to loose jobs?
(Typical first socio-economic implication)
- ❑ Automation as synonymous with increased well-being for the general population?
- ❑ Increased business productivity and a resurgence in economic growth?



Unjustified Worries?

- ❑ Labor gets more expensive, technology cheaper.
- ❑ Machines will do everything faster with fewer mistakes.
- ❑ Machines will do everything cheaper.
- ❑ Certainly, many jobs will disappear, **but how many new will appear?**

Understanding Possible Impacts

- ❑ To understand the impacts, we need to deeply understand
 - ❑ Main aspects.
 - ❑ Opportunities.
 - ❑ Risks.

Three Main Aspects

- ❑ **Significance of data**

- ❑ data are at heart of transition to digital technology: AI opens new ways

- ❑ **Machines continue to serve humans**

- ❑ Technical device must improve working capacity, conditions

- ❑ **Methods**

Significance of Data: All Industries

- ❑ Humans not able to analyse massive amounts of data.
- ❑ AI systems are better equipped for analysis.
- ❑ Large impact on decision making.



Big Data the Phenomenon

- ❑ “How big are your data?”
- ❑ Depends on WHEN you ask the question!
- ❑ 50 years ago (in economics): 90 observations on each of 10 variables.
- ❑ 2010+: we do not count, report size instead: 200 GB.
- ❑ 2025: do we even want to know? Explosive growth in available data.
- ❑ International Data Corporation estimates that there may be 163 zettabytes (one trillion gigabytes) of data by 2025, or ten times the data generated in 2016

Big Data the Phenomenon

- ❑ Vast data available today
 - hundreds of billions of observations and millions of features.
 - A 100,000,000,000x1,500,000 dimensional tables/matrices common.
- ❑ Allows analyses unthinkable 15 years ago.
- ❑ Presents challenges to econometricians, computer scientists and statisticians
 - How to get that matrix into a computer.
- ❑ Can you get that matrix into a computer
 - If so how do you interpret 1.5 million independent variables.
- ❑ Can you interpret 1.5 million independent variables.

Machines: Computing Power

- ❑ Cambridge, early 1950s:
computation still largely done
on Marchant electric
calculators.
- ❑ Takes days.



Machines: Computing Power



- ❑ Your smartphone is millions of times more powerful than all of NASA's combined computing in 1969.
- ❑ Computing power growing exponentially every year.

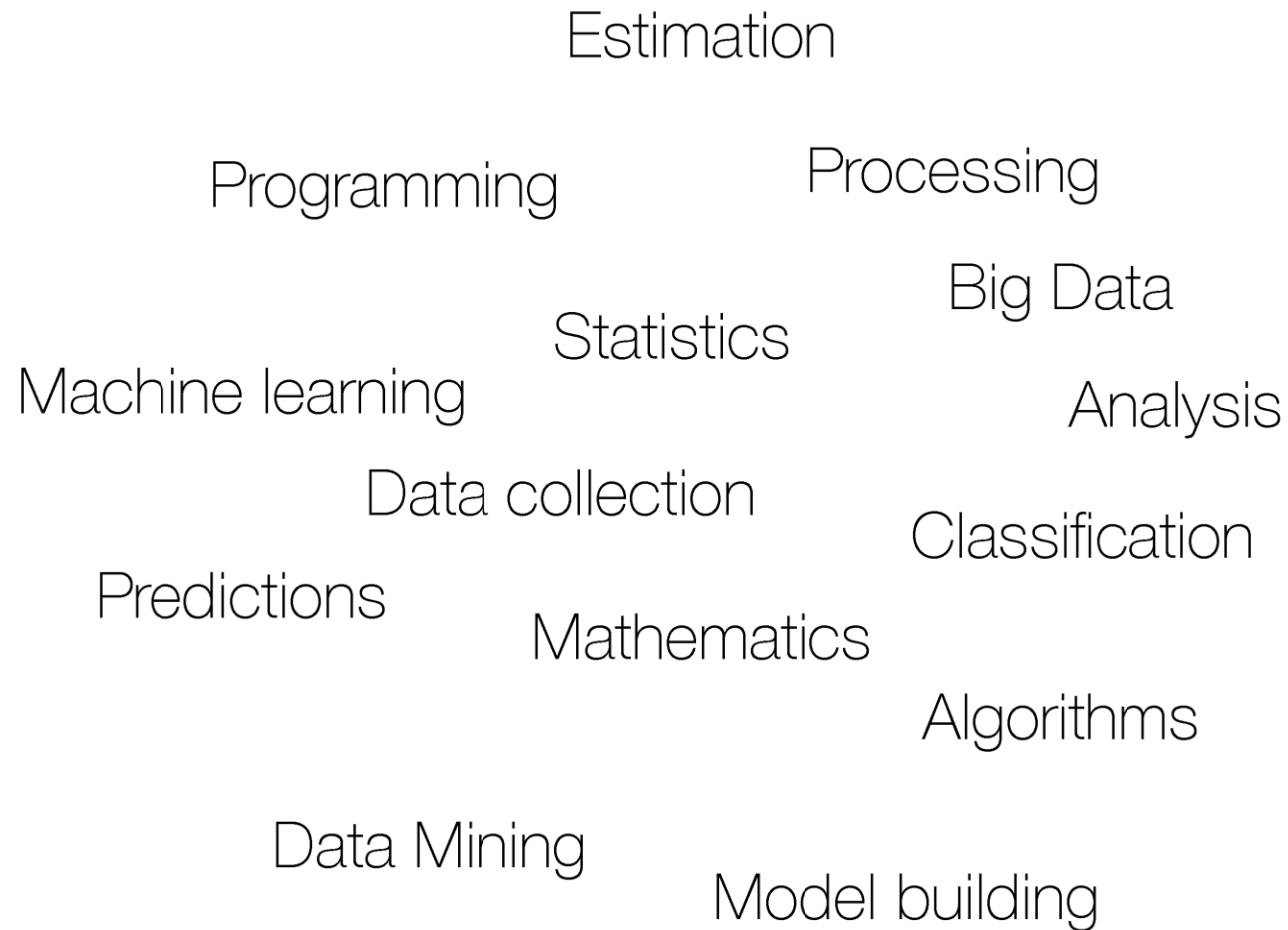
What is AI, Data Science, Data Analytics, ML about?

Big data

and

Large scale computations?

What is AI, Data Science, Data Analytics about?



AI and Global Economic Activity

- ❑ Large potential for AI to contribute to global economic activity
- ❑ Companies will likely use increasingly AI: computer vision, natural language, virtual assistants, robotic process automation, and advanced machine learning.
- ❑ Work profiles will change considerably: specialised skills required.

AI Could Widen Gaps in Society

- ❑ Leaders of AI adoption could increase their lead in net economic benefits.
- ❑ Gap between front-runner companies and non-adopters may be large.
- ❑ Low level digital skill jobs and jobs requiring complex technical digital skills may create large gap too.

Methods Decision Making

- ❑ Economics is about modelling decision making.
- ❑ Traditionally, we try to theoretically explain decisions of consumers, companies, insurers, etc. (i.e. rational inattention)
- ❑ Premise is that economic agents maximise their utility (from consumption, wealth, etc.)
- ❑ Often, theoretical model fails since decision making is so complex.

Decision Making

- ❑ AI instead “learns” this behavior from data.
- ❑ BUT can not explain it.
- ❑ Challenge and Risk: Should we rely on data and computation (AI) driven understanding that can not be explained?
- ❑ Current research towards **interpretable machine learning**.

Tech or Social Studies Issue?



AI and Main Aspects of Social Studies

1. Culture: AI/ML changes social interactions.
2. Time, Continuity and Change: Traditionally we study past and its legacy, everyone is experiencing more novelty with AI.
3. People, Places and Environments: Cameras, facial recognition, tracking...
4. Individual Development and Identity: AI augments human capacity in every aspect of life, how will this change human identity?
5. Individuals, Groups and Institutions: Automation of job market, decision about hiring, loans.

AI and Main Aspects of Social Studies

6. Power, Authority and Governance: How do we guide use of AI/ML? How to frame legislation?
7. Production, Distribution and Consumption: Accelerating wealth aggregation, different consumption behavior.
8. Science, Technology and Society: New privacy and security concerns.
9. Global Connections.
10. Civic Ideals and Practices: AI sending waves of issues (e.g., climate change, autonomous vehicles, employment dislocation, privacy)

Epilogue

- ❑ AI already influences our everyday lives.
- ❑ We just have to learn how to use it smartly.
- ❑ Many exciting breakthroughs in AI recently.
- ❑ But significant challenges remain.

Epilogue

- ❑ AI still at its onset of the change process for society.
- ❑ Helps to analyze data and use it to make efficient decisions.
- ❑ New opportunities that will drive innovation and create new ideas.
- ❑ Yet, we are facing 4th industrial revolution with its social, economic and societal implications.



Historical Overview

- ❑ Much of the new stuff is quite old.
- ❑ Impossible to do in its days.
- ❑ Made possible by advances in Computer Science, Mathematics, Statistics and Economics (Social Sciences).
- ❑ It is good to understand and this interdisciplinary connections.

Historical Overview

- ❑ Causality and identification
 - Economics 1950, Leonid Hurwicz (Economics 2007, Nobel Prize winner)
 - Computer Science 1998, Judea Pearl (UCLA)
- ❑ Tree methods
 - Economics 1963, James N. Morgan (U of Michigan)
 - Statistics 1984, Leo Brieman (Berkeley)
- ❑ Map Reduce
 - Economics 1980, Gregory M Duncan
 - Computer Science 2004, Jeffrey Dean and Sanjay Ghemawat (Google)

Historical Overview

- ❑ Bagging/Ensemble Methods
 - Economics 1969, Bates and Granger (UCSD)
 - ML 1996, Breiman (almost of course)
- ❑ Economists early contributors to neural net/deep learning literature (late 1980's early 1990's)
 - Hal White, Jeff Wooldridge, Ron Gallant, Max Stinchcombe
 - Quantile neural nets, learning derivatives, guarantees for convergence, distributions etc.
 - Needed for counterfactuals when out of sample validation make no conceptual sense



100 let

České společnosti

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