

The Moral Imperatives of Artificial Intelligence

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AI Breakthroughs, I

- ◆ 1997: IBM's Deep Blue beats Kasparov.



AI Breakthroughs, II

- ◆ 2011: IBM's Watson defeats the two greatest Jeopardy! champions, Brad Rutter and Ken Jennings, by a significant margin.



AI Breakthroughs, III

- ◆ 2016: AlphaGo beats Lee Se-dol to take the Google DeepMind Challenge series!



The Inexorable March of AI

- ◆ "AlphaGo combines tree-search techniques with search-space-reduction techniques that use deep learning."
 - In other words, AlphaGo develops "intuition" for Go playing.
- ◆ Machine learning provides a response to Polanyi's Paradox (1966): "We can know more than we can tell... The skill of a driver cannot be replaced by a thorough schooling in the theory of the motorcar"

Automated Driving, I

- ◆ 2005: DARPA Grand Challenge - Stanford autonomous vehicle drives 131 miles along an unrehearsed desert trail.



Automated Driving, II

- ◆ 2007: DARPA Urban Challenge - CMU autonomous vehicle drives 55 miles in an urban environment while adhering to traffic hazards and traffic laws.



Automated Driving, III



Costs of Manual Driving

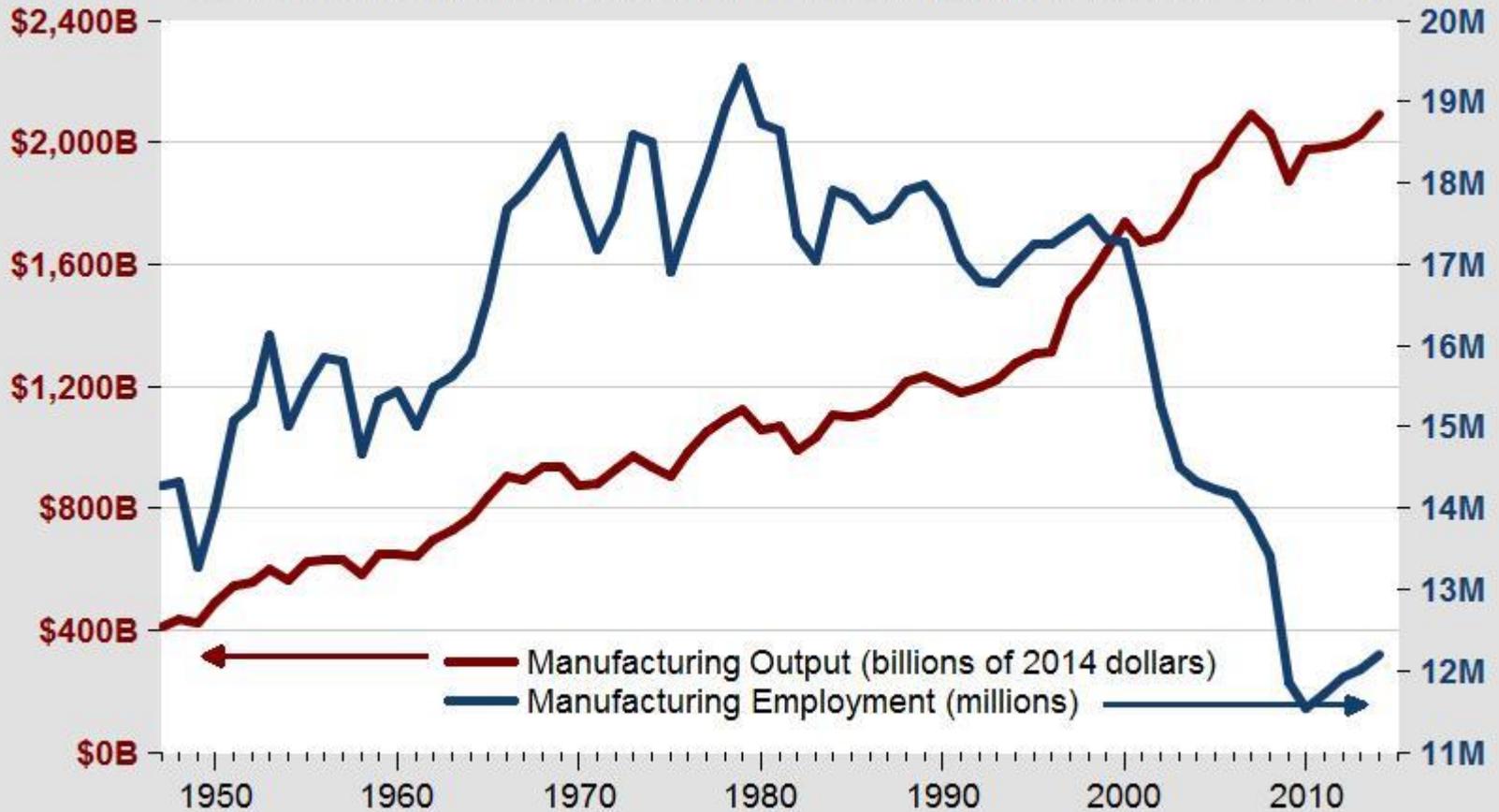
- ◆ 1.25M deaths in 2013
- ◆ 20-50M are injured or disabled
- ◆ More than half of all road traffic deaths occur among young adults ages 15-44
- ◆ Road crashes are the leading cause of death among young people ages 15-29,
- ◆ Road crashes cost > \$0.5T globally
- ◆ Human error accounts for 90% of road accidents

The Automation of Driving

- ◆ 30 companies are now making self-driving cars
- ◆ Technical issues are expected to be resolved within a decade
- ◆ Many legal issues need to be resolved
- ◆ Profound business consequences (e.g., cars are now idle 90% of the time)
- ◆ ***Massive loss of jobs*** (10% of US jobs involve operating a vehicle): automation of the ***whole*** supply chain is expected - tens of millions of jobs globally!

Decoupling in Manufacturing

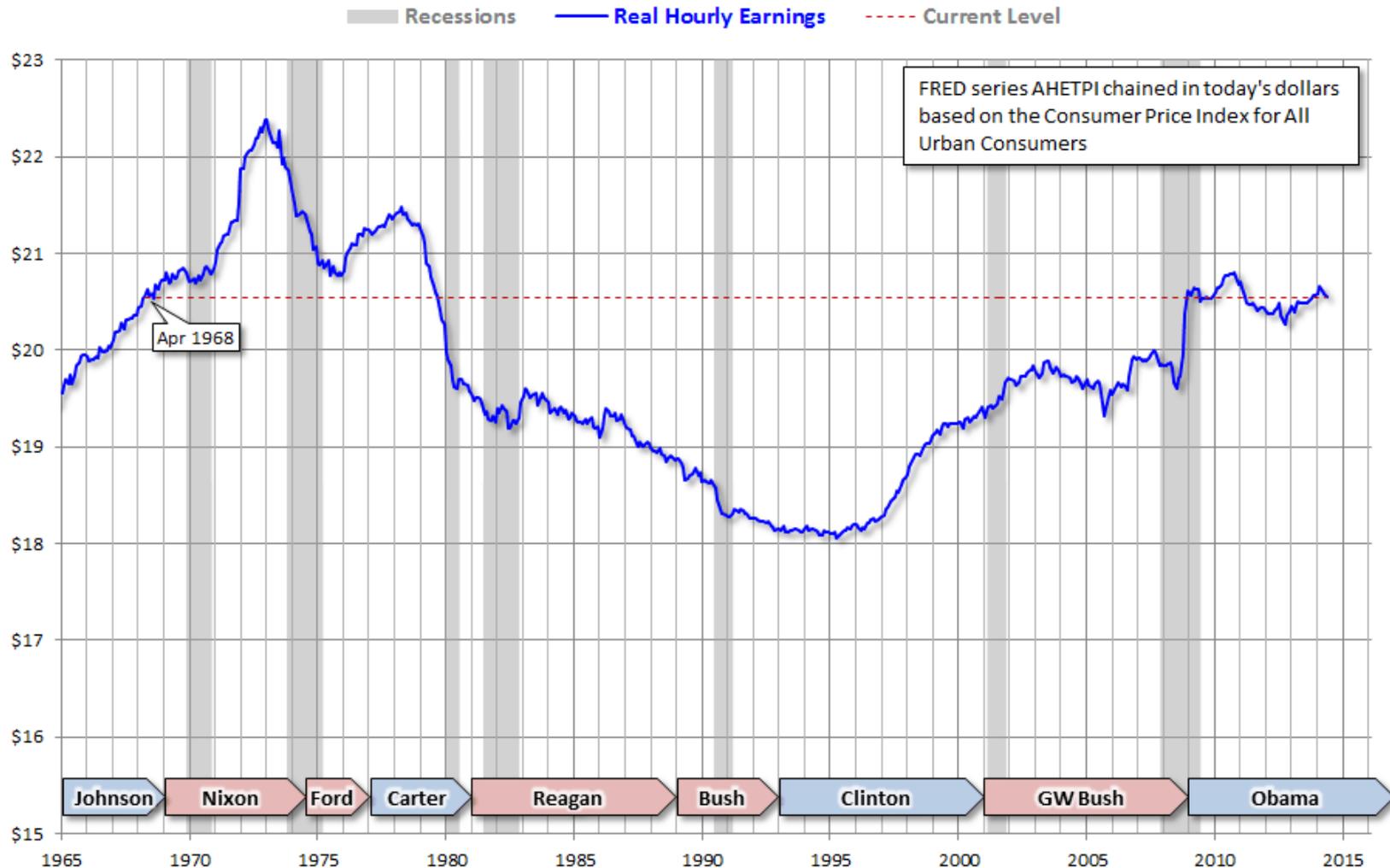
US Real Manufacturing Output vs. Employment, 1947 to 2014



Real Hourly Earnings

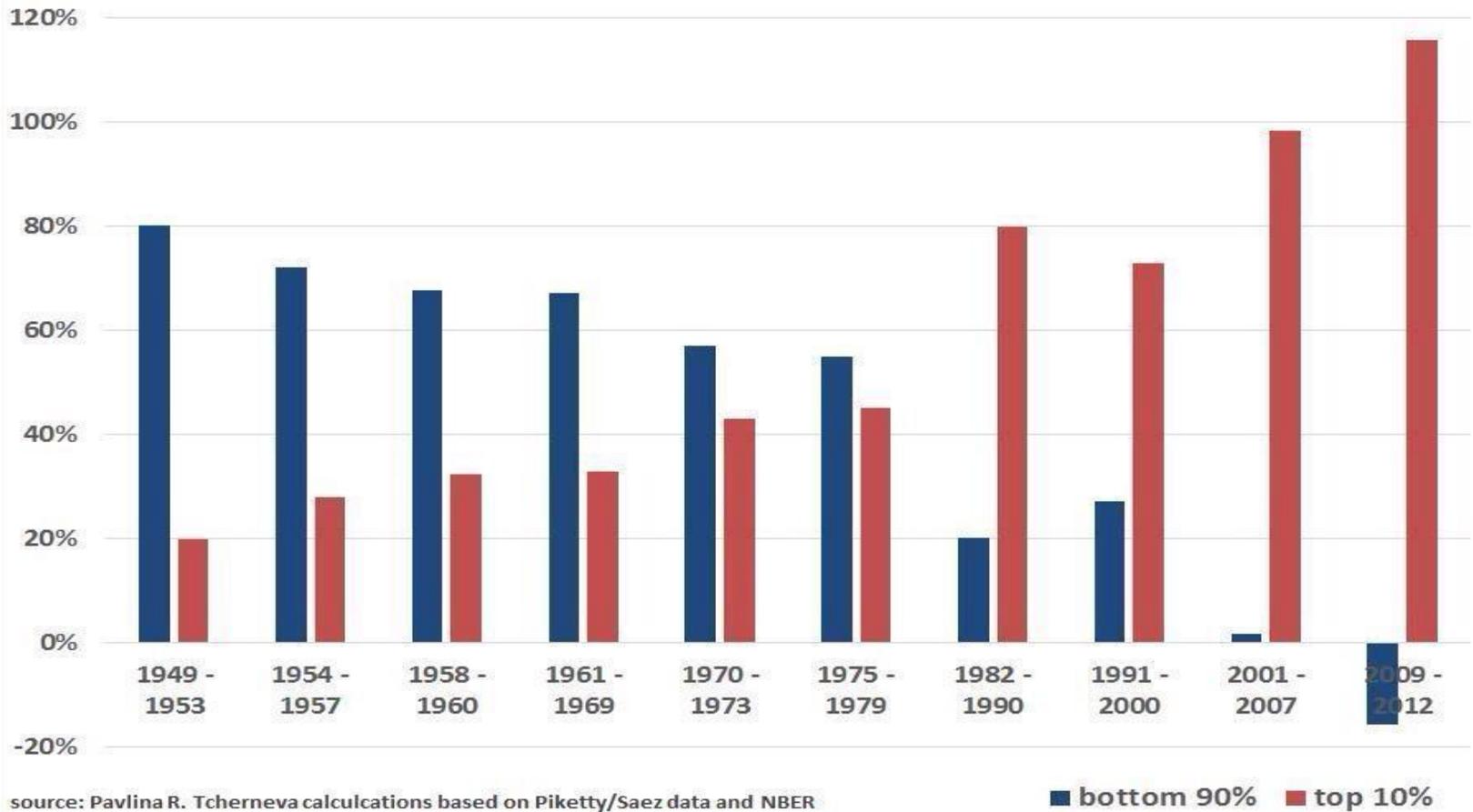
Real Average Hourly Earnings of Production and Nonsupervisory Employees: Total Private

dshort.com
June 2014
Data through May



Growing Inequality

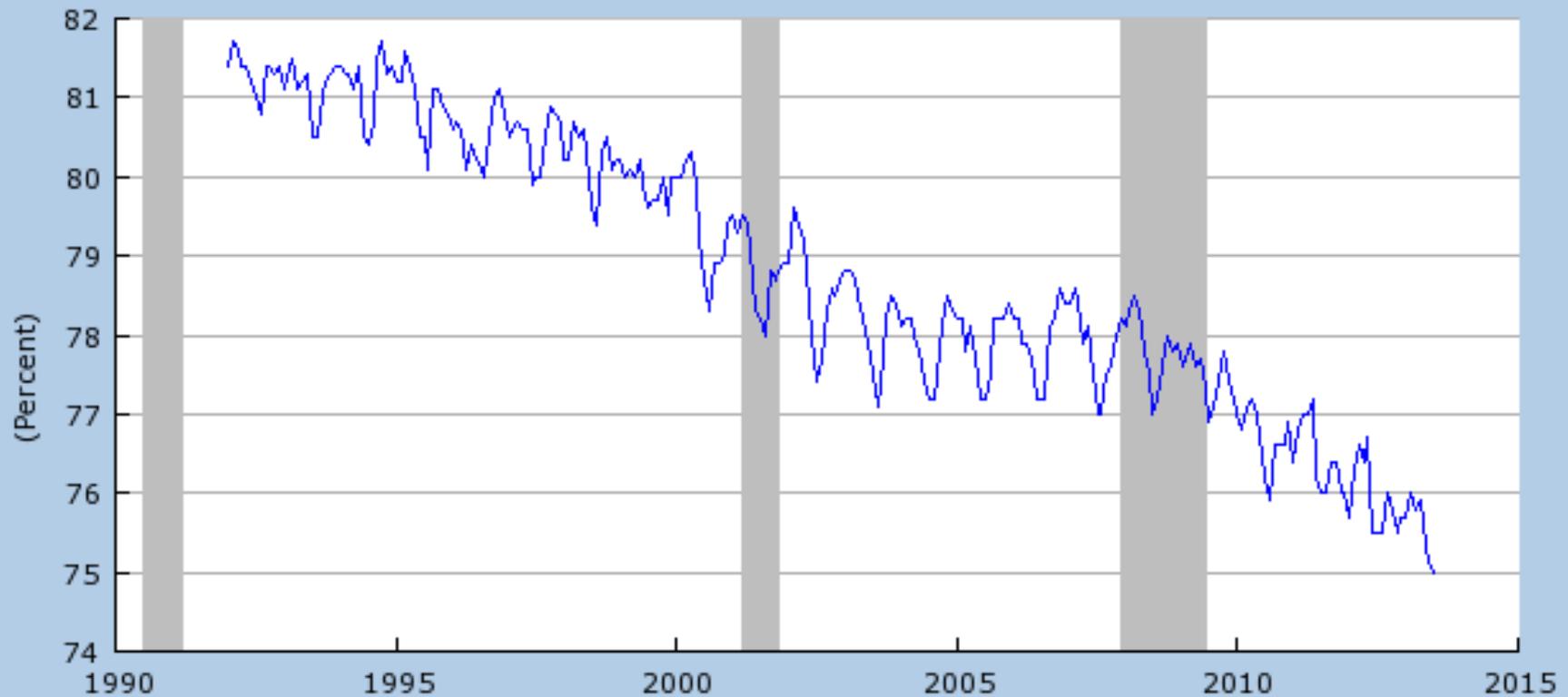
Distribution of Average Income Growth During Expansions



Labor Force Participation

Civilian Labor Force Participation Rate - Bachelor's degree and higher, 25 years and over (LNU01327662)

Source: U.S. Department of Labor: Bureau of Labor Statistics



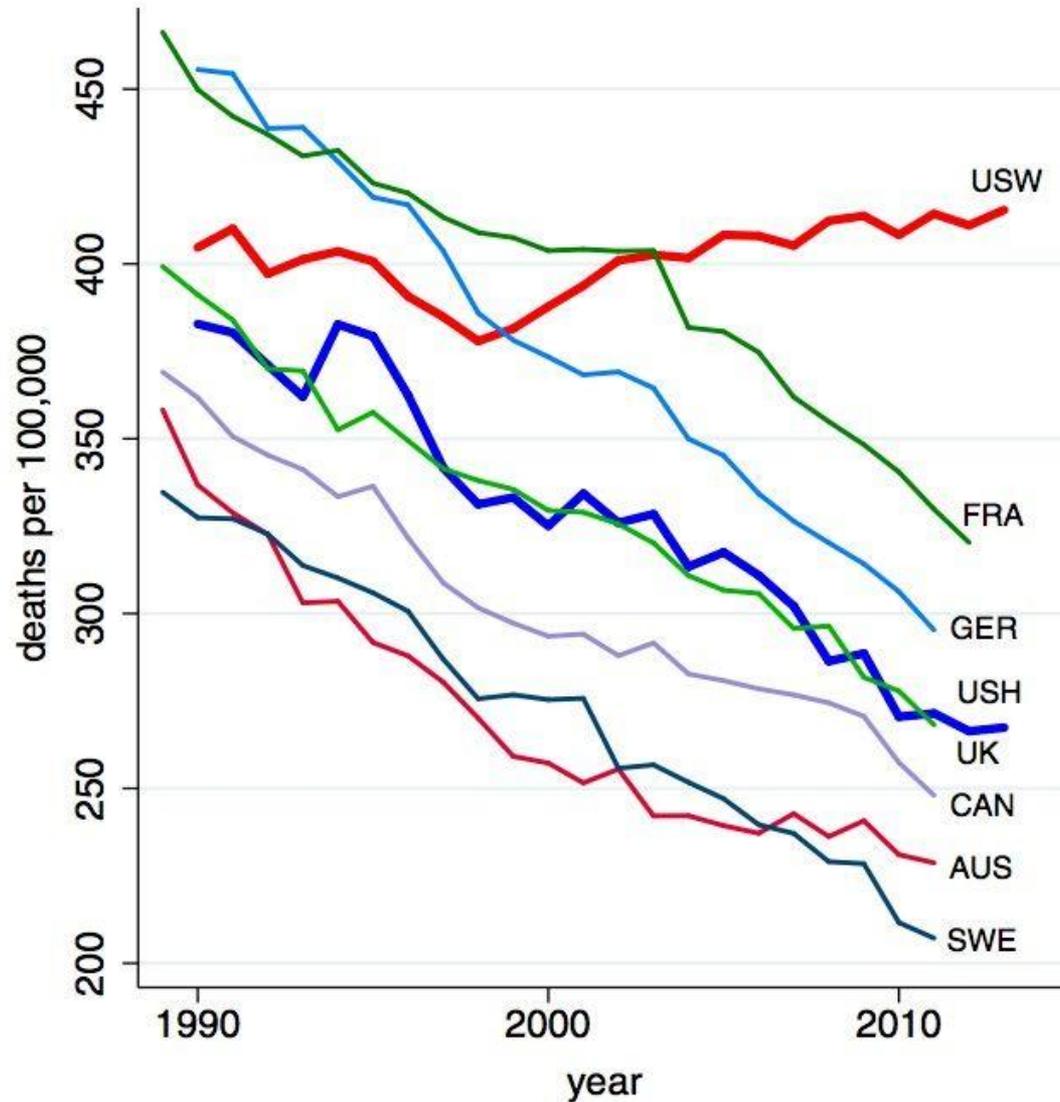
Shaded areas indicate US recessions.
2013 research.stlouisfed.org



Wages vs. GDP



US White Mortality, 45-54



Death vs Trump

◆ Washington Post, March 4, 2016:

"Eerie correlation in the voting data: it seems that Donald Trump performed the best in places where middle-aged whites are dying the fastest."

Moral Imperatives

1. We must develop and deploy automated driving, to save lives and reduce injuries and property damage
2. We must acknowledge the societal consequences of automated driving
3. We must be engaged in the discussion/solutions for such consequences.

Humans, Machines, and the Future of Work

- ◆ A conference at Rice University
- ◆ Dec. 5-6, 2016
- ◆ delange.rice.edu