Artificial Intelligence: Strategic Perspectives

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National Security Affairs / Cyber Academic Group

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AI and Strategy

Outline of Remarks

I.   Strategic Context

   Strategic concepts; AI applications (tactical, operational, strategic)

II.   Strategic Competition

   U.S., China, Others

III. Strategic Environment

   Arms racing, Offense-defense, Social dimension

> *"The convergence of the artificial intelligence revolution and the reemergence of great power competition must focus the American mind."*
>
> First sentence, *Interim Report of the National Security Commission on Artificial Intelligence*, November 2019

I / Strategic Concepts

- Strategy Definitions
  - Political objectives
- Dimensions of Strategy
  - Logistical
  - Operational
  - Social

Clausewitz

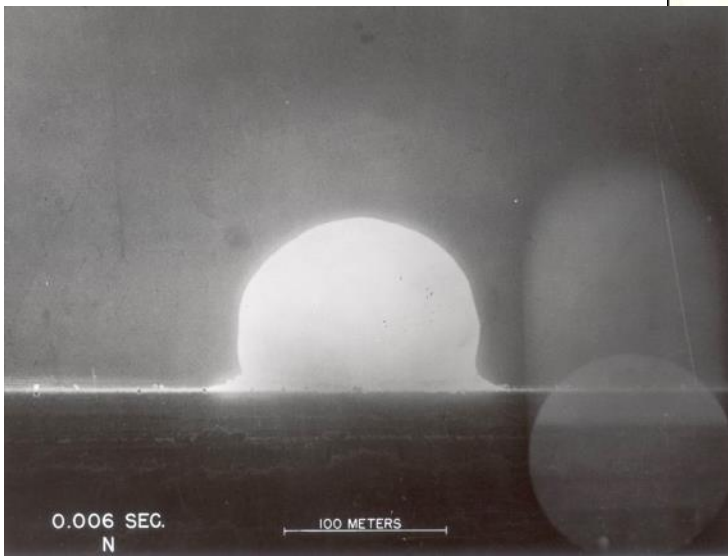"the use of engagements for the object of war"

Hart

"the art of distributing and applying military means to fulfill the ends of policy"

Howard

"the deployment and use of armed forces to attain a given political objective"

I / Strategic Concepts

- Strategy Definitions
- Dimensions of Strategy
  - Logistical
  - Operational
  - Social
  - *Technological*

I / Strategic Concepts

- Strategy Definitions
- Dimensions of Strategy
- Modern Strategy
    - Grand strategy & broader aspects of war
    - Inversion of conquest and defeat
    - Technological v. social dimensions

I / AI Applications

- AI is Power
  - Force v. coercion
- Tactical Applications
  - Logistics and transport
  - Autonomous control
  - Target identification
  - Battle management
  - Network protection
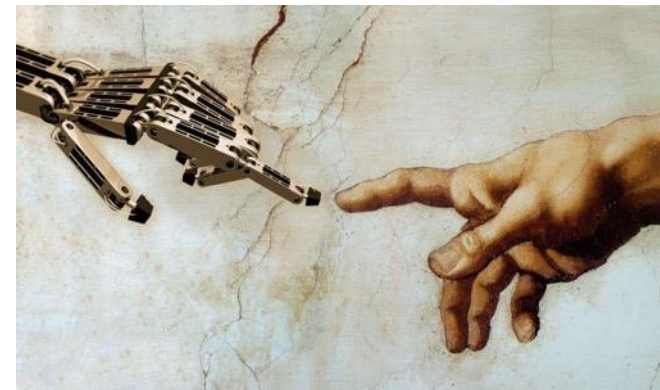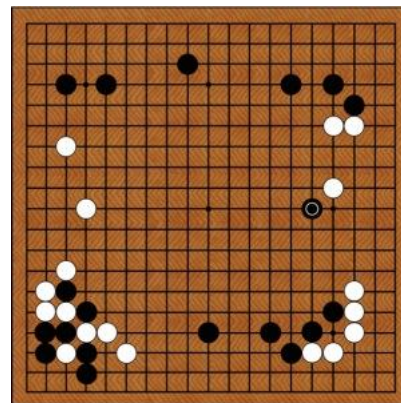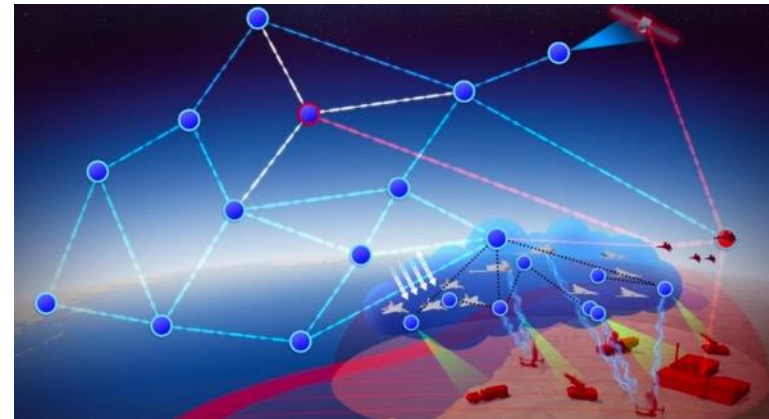 - Battlefield medical care

I / AI Applications

- AI is Power

- Tactical Applications

- Operational Decision-making
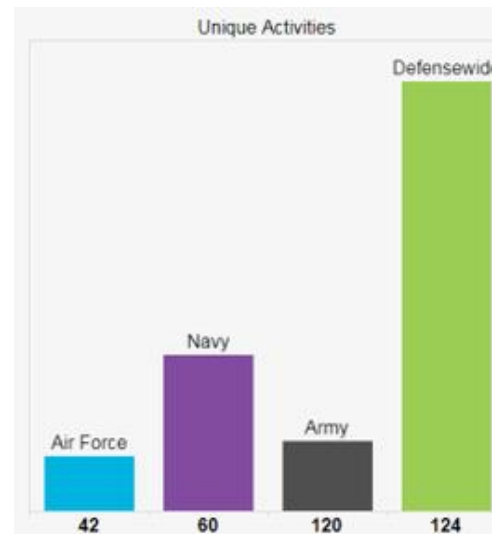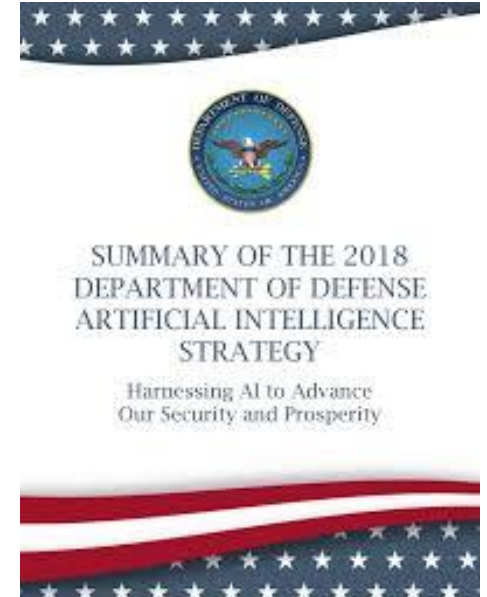 - Situational awareness
  - Risk analysis

I / AI Applications

- AI is Power
- Tactical Applications
- Operational Decision-making
- Strategic Influences
  - Command and control
  - Limited grasp of human meanings
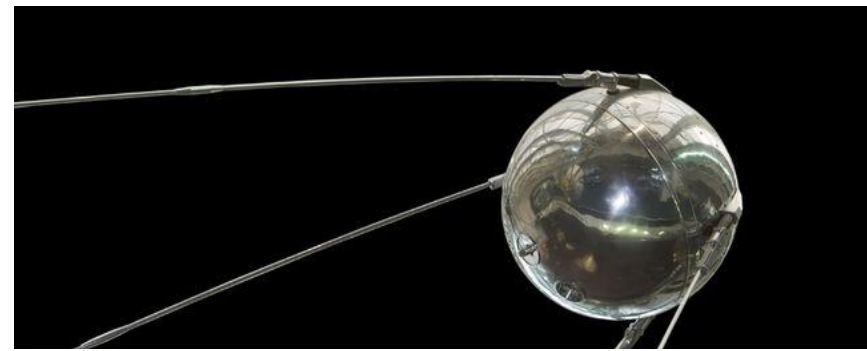 - Challenge of trust

II / United States

- Policy direction
  - Clear acceleration
  - Strategy of inclusion
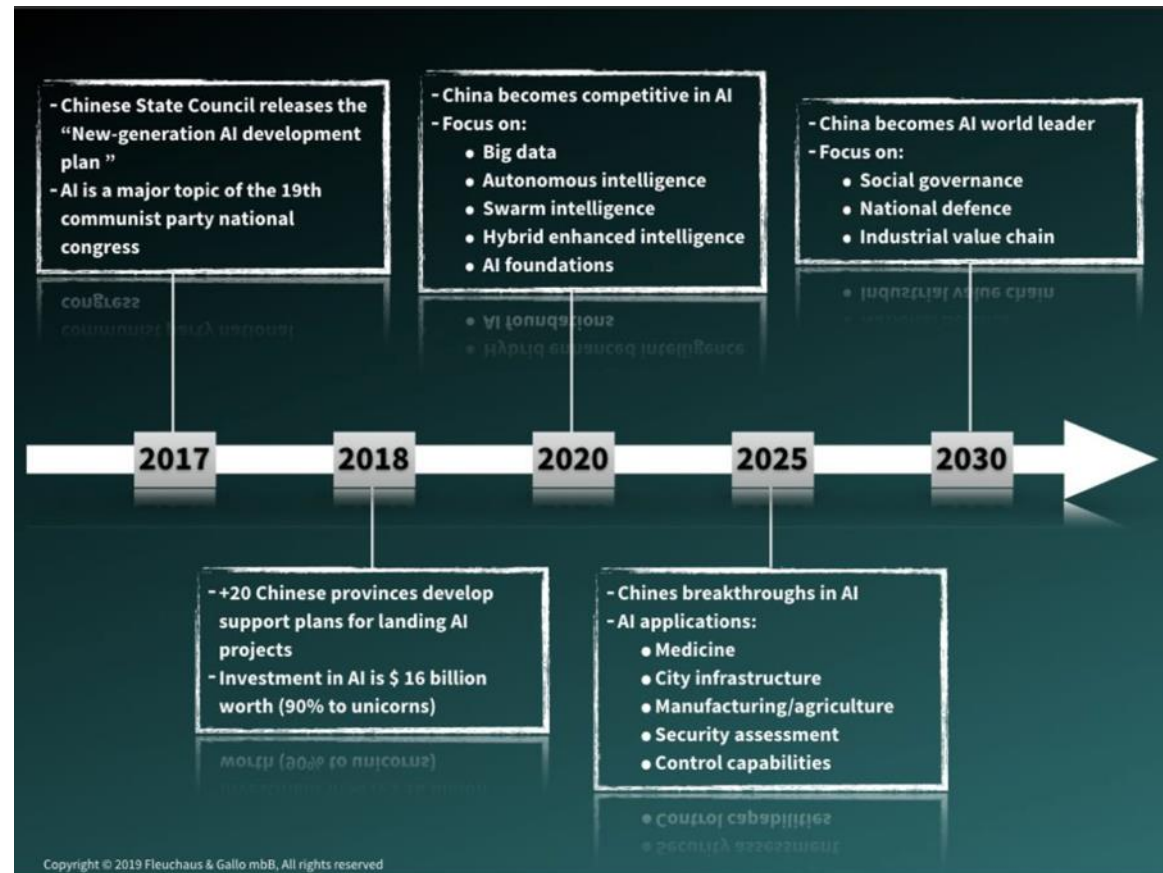- Resourcing
  - USG + private sector

SUMMARY OF THE 2018
DEPARTMENT OF DEFENSE
ARTIFICIAL INTELLIGENCE
STRATEGY

Harnessing AI to Advance
Our Security and Prosperity

Unique Activities

Air Force	Navy	Army	Defensewide
42	60	120	124

BA #	Budget Activity Title (group)	Unique Activities	FY2020 Funding
1	Basic Research	62	$569.49
2	Applied Research	122	$908.35
3	Advanced Technology Development (ATD)	86	$814.76
4	Advanced Component Development & Prototypes (ACD&P)	34	$821.49
5	System Development & Demonstration (SDD)	9	$80.27
6	RDT&E Management Support	16	$429.93
7	Operational Systems Development	17	$398.11
	Grand Total	346	$4,022.39

II / China

- "Sputnik moment"
- Policy direction

国务院关于印发
新一代人工智能发展规划的通知
国发〔2017〕35号

Chinese State Council releases the "New-generation AI development plan"
- AI is a major topic of the 19th communist party national congress

China becomes competitive in AI
- Focus on:
  - Big data
  - Autonomous intelligence
  - Swarm intelligence
  - Hybrid enhanced intelligence
  - AI foundations

China becomes AI world leader
- Focus on:
  - Social governance
  - National defence
  - Industrial value chain

2017   2018   2020   2025   2030

- +20 Chinese provinces develop support plans for landing AI projects
- Investment in AI is $ 16 billion worth (90% to unicorns)

Chines breakthroughs in AI
- AI applications:
  - Medicine
  - City infrastructure
  - Manufacturing/agriculture
  - Security assessment
  - Control capabilities

II / China

- "Sputnik moment"
- Policy direction
- Military applications
- Social implementation
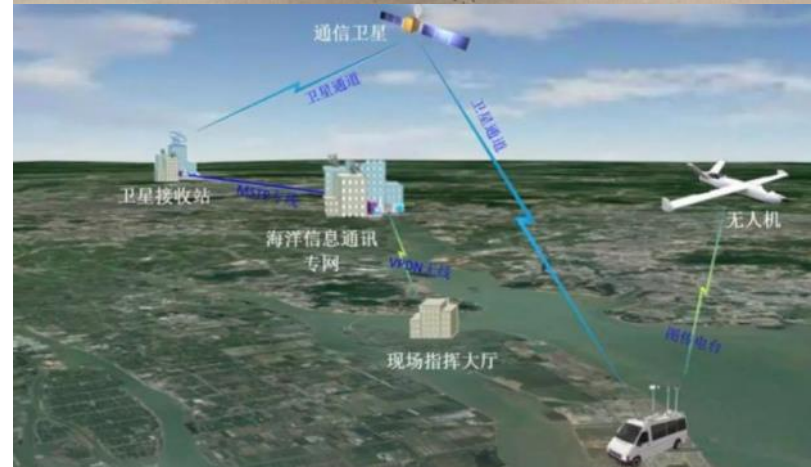
II / US-China

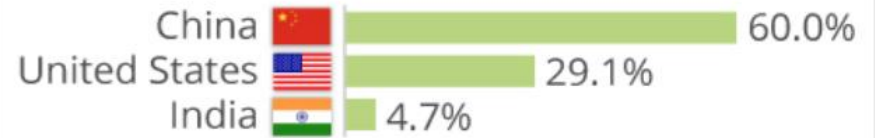| Area	U.S.	China

AI Researchers
  "Top" Researchers (H-index)
	28,536
	  5,158 (18%)
		18,232
		  977 (5%)

"Top" AI Researcher Ph.D. Source	44%	11%
Published Papers Impact (FWCI)	1.83 (83% > avg.)	0.94 (6% < avg.)
Capital Resourcing (VC + PE)	$16.9 billion	$13.5 billion
Highly Cited AI Patents (1960-2018)	28,031	691
Firms Adopting / Piloting AI	22% / 29%	32% / 53%
GDP Payoff Projection 2030	$3.7 trillion (14.5%)	7.0 trillion (26.1%)
Semiconductors: # Firms Top 15 Sales # Firms Top 10 R&D # Firms Designing AI Chips	6 5 55	1 0 26
# Supercomputers in Top 500	92	219

AI: A Two Horse Race For Global Dominance

Countries with the highest shares in the following areas of artificial intelligence

Share of global AI patent applications from 1997 to 2017

- China: 37.1%
- United States: 24.8%
- Japan: 13.1%
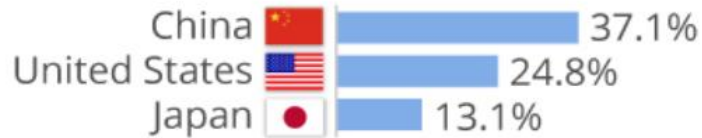
Share of global AI investment and financing from 2013 to Q1 '18

- China: 60.0%
- United States: 29.1%
- India: 4.7%

Share of AI experts/talents worldwide in 2018

- United States: 16.5%
- China: 9.4%
- India: 8.5%

Share of papers published in the field of AI from 1997 to 2017

- United States: 22.1%
- China: 19.6%
- United Kingdom: 5.8%

Share of AI companies as of June 2018

- United States: 41.0%
- China: 20.5%
- United Kingdom: 8.0%

statista

Biggest AI startups
(Source: CB insights — Feb. 2019)
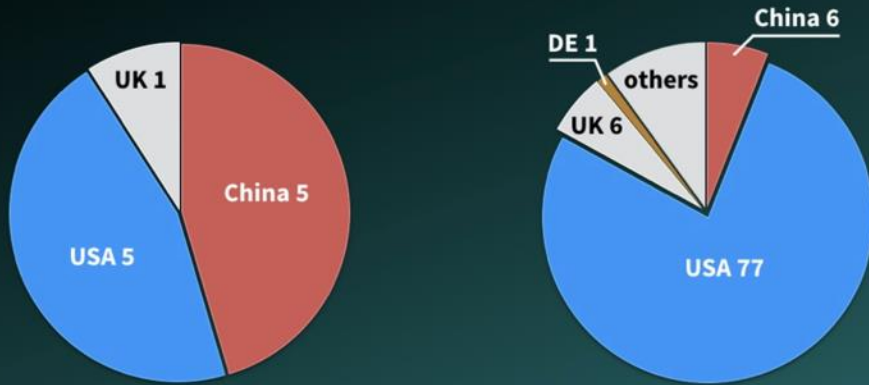
Top AI unicorn startup — UK 1, USA 5, China 5

Top 100 AI startups — China 6, DE 1, others, UK 6, USA 77

Top 20 universities in AI research
(Source: WIPO Technology Trends 2019 Artificial Intelligence — 2019)

France 1, Singapore 2, Japan 1, USA 6, China 10
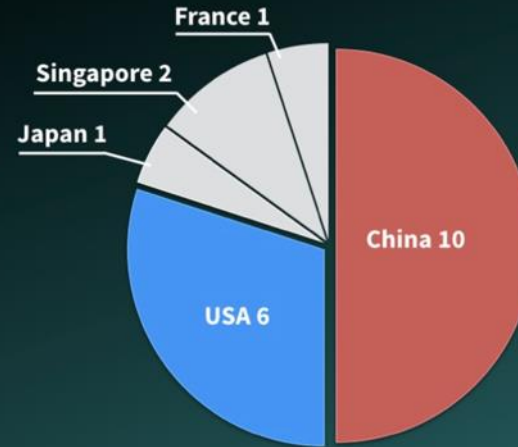
Top 20 Universities and public research organisations by number of papers

ACTIVE PLAYERS IN AI
(Source: Boston Consulting Group — Dec. 2018)

AI adoption, AI piloting

China: 32% adoption, 53% piloting
USA: 22% adoption, 29% piloting
France: 20% adoption, 29% piloting
Germany: 20% adoption, 29% piloting
Switzerland: 15% adoption, 31% piloting
Austria: 13% adoption, 29% piloting
Japan: 11% adoption, 28% piloting
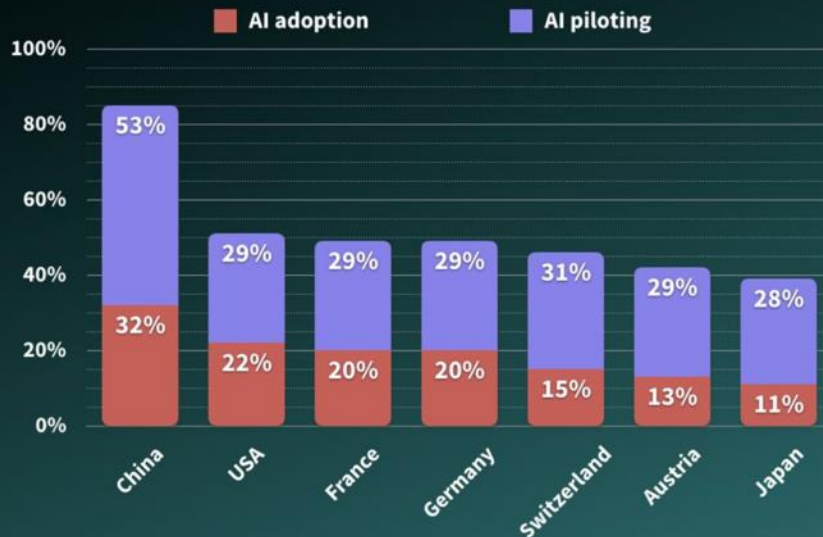
Patent filings by patent office
(Source: WIPO Technology Trends 2019 Artificial Intelligence)

Number of patent applications filed — USA, China, Japan, WIPO, EPO, Rep. of Korea, Germany
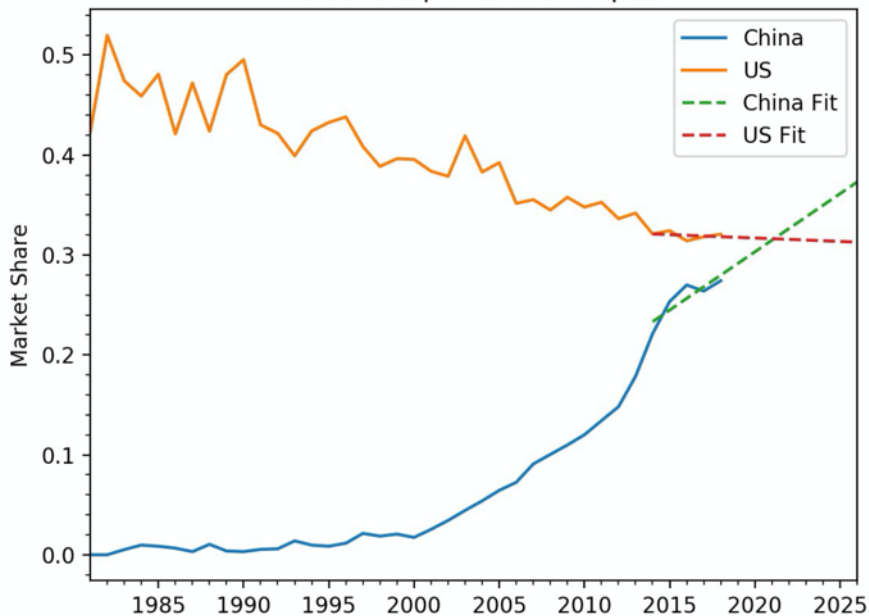
13
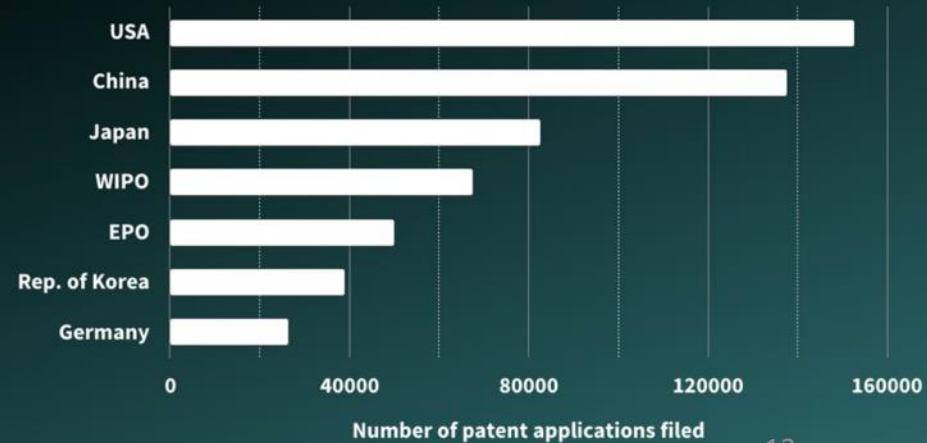
Field-weighted citation impact, 1998–2016
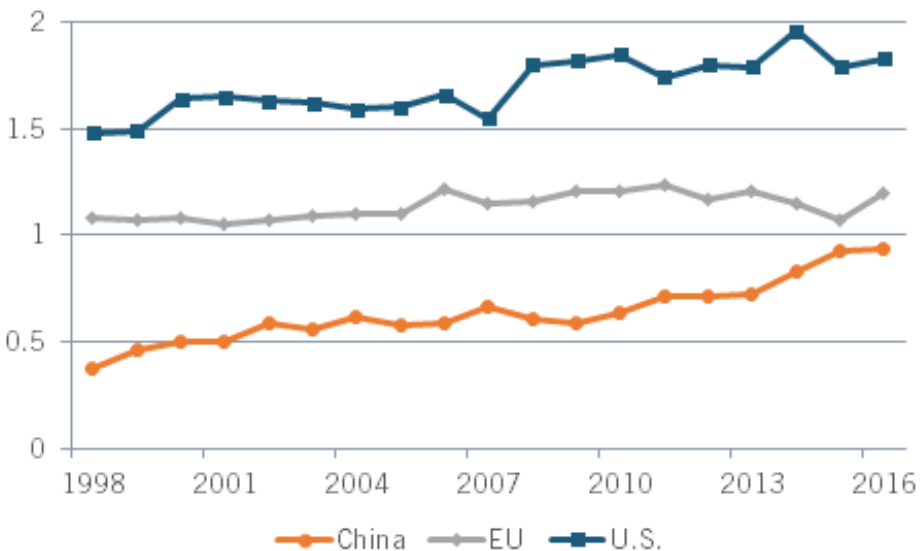
Share of top 50% of AI Papers
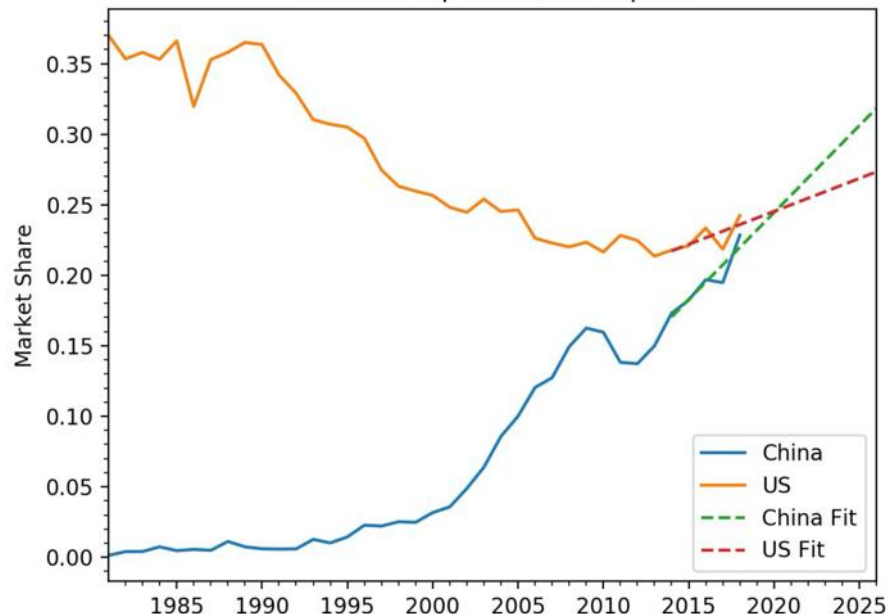
Share of top 10% of AI Papers

Share of top 1% of AI Papers

14
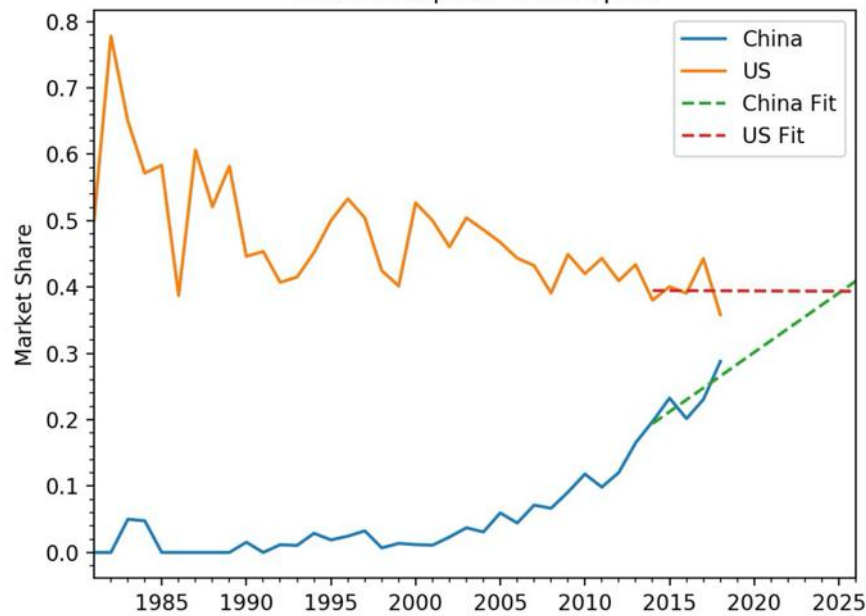
Data (2018)	U.S.	China
IoT Data (TB millions)	69	152
Broadband Subscriptions (millions)	109.8	394.2
Mobile Payments (millions / percent)	55.0 (20%)	525.1 (45%)

Global Datasphere by Region
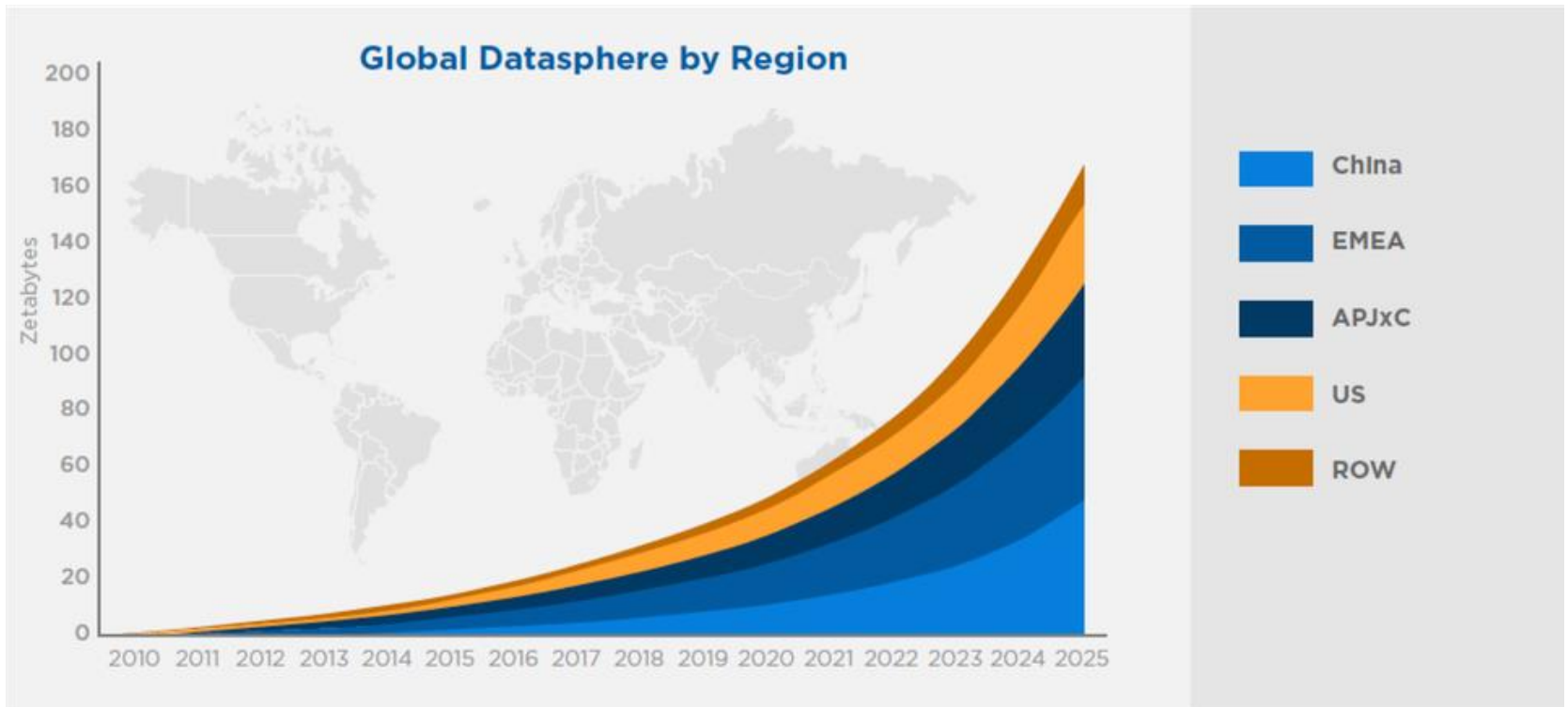
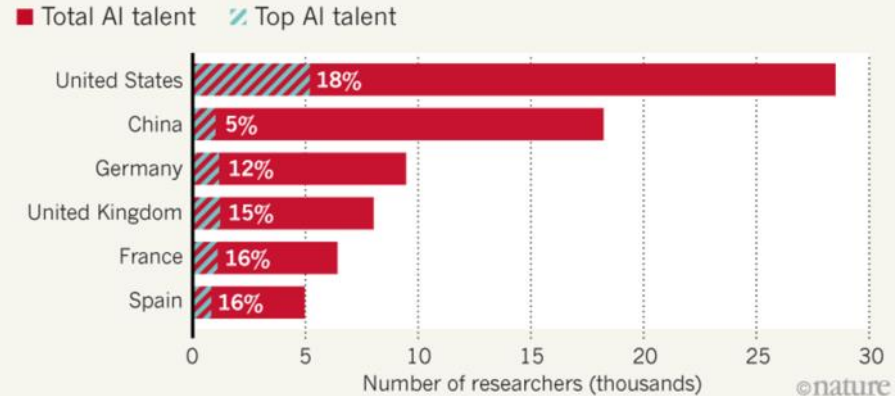Source: IDC's Data Age 2025 study, sponsored by Seagate

II / Others

- European Union
- Russia
- Other actors?
  - Asymmetric power diffusion?

AI TALENT CONCENTRATION

China has the second-largest number of researchers who have published AI papers or been issued patents in the past decade. But the proportion of those considered to be in the top 10% of the field is smaller than in other AI-leading nations.

■ Total AI talent ⬚ Top AI talent

Country	Top AI talent %
United States	18%
China	5%
Germany	12%
United Kingdom	15%
France	16%
Spain	16%

Number of researchers (thousands) — 0 to 30

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Category	China	European Union	United States
Talent	3	2	1
Research	3	2	1
Development	3	2	1
Adoption	1	2	3
Data	1	3	2
Hardware	2	3	1

Машинное обучение
Machine learning

III / Arms Race

- Perception of Utility
- Consequences
  - Instability?
  - Premature Deployment
- Arms Control?
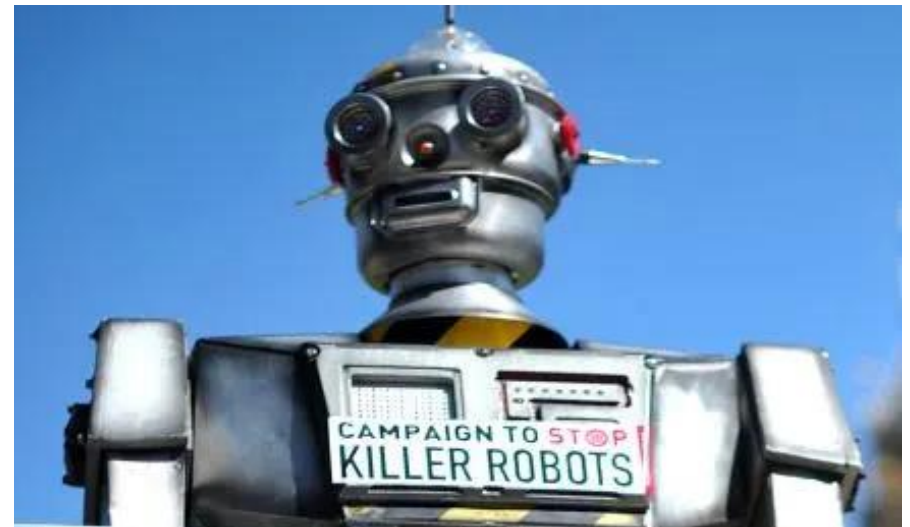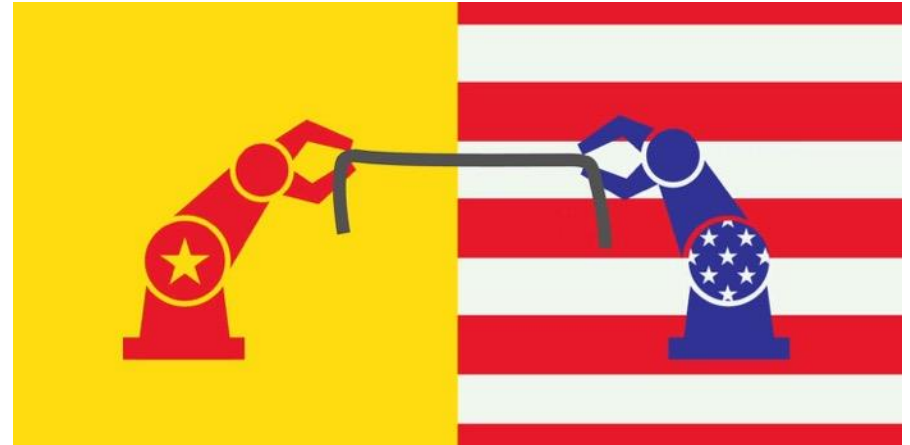
III / Offense-Defense Balance

- Shared Applications
- Uncertain Applications
- Opaque Applications

III / Sociological Dimension

- Intrinsic Factor of Strategy
- Cold War Expression
- Strategy in the Information Age

"Each of us is convinced of our inability, within the confines of our respective fields of expertise, to fully analyze a future in which machines help guide their own evolution."

- **Henry Kissinger**, former U.S. Secretary of State and National Security Advisor
- **Eric Schmidt**, Chairman of the DoD Innovation Board; former CEO and Executive Chairman of Google and Alphabet.
- **Daniel Huttenlocher**, Inaugural Dean, Schwarzman College of Computing, Massachusetts Institute of Technology.

"The Metamorphosis," *The Atlantic,* August 2019