AI SUMMIT 2021 SEOUL

State of AI 2021

Gleb Chuvpilo December 2021

Gleb Chuvpilo Managing Partner @ Thundermark



Investor

- Managing Partner @ Thundermark Capital, and early-stage deep tech venture capital fund backed by Peter Thiel (Miami).
- Previously Venture Partner @ Hardware Club, Rewired and Peak State Ventures (NYC, London, Paris, Lausanne, Zurich).
- Previously **Portfolio Manager** @ **Thiel Macro** (Peter Thiel's global macro hedge fund).
- Previously Al-Driven Quantitative Trader @ Goldman Sachs (\$10B hedge fund).

Scholar

- MS in Electrical Engineering & Computer Science @ MIT. Focus: Artificial Intelligence and Robotics.
- MBA in Finance & Strategic Management @ Wharton. Focus: Venture Capital Investment Strategy.
- Chartered Financial Analyst (CFA) & Member of the New York Society of Security Analysts (NYSSA).

Serial Entrepreneur

- Previously Founding Engineer @ Pager (\$132.6M raised; VCs include NEA & Lux; partnerships covering 15 million patients).
- Previously Co-Founder & Head of R&D @
 Ride (TPG Growth portfolio company; acquired by Enterprise Holdings in 2016).
- Previously Co-Founder & CEO @ Authy (YC W12; acquired by Twilio in 2015).
- Previously **Early Engineer @ Palantir Technologies** (designed AI algorithms).

Researcher

- Previously Researcher in Al & Robotics @ MIT Computer Science and Artificial Intelligence Lab (designed SLAM algorithms for autonomous underwater vehicles for the US Navy).
- Previously Researcher in Computational Genomics @ Broad Institute at MIT and Harvard (with Nick Patterson).

We Invest in Deep Tech AI, Robotics, and Blockchain



- Deep Tech startups provide technology solutions based on substantial scientific or engineering challenges.
- The most prominent **deep tech fields** include advanced materials, advanced manufacturing, artificial intelligence, biotechnology, blockchain, robotics, photonics, electronics, and quantum computing.
- Our fund focus is on the Artificial Intelligence, Robotics, and Blockchain verticals, which are in the sweet spot for the fund investment horizon.

What is Common Across AI Startups? **Startups**



Error rates on ImageNet Visual

Machines are now better at vision than humans (source: Stanford)



Example of the Stanford vision AI algorithm in action

- Deep Learning is a class of Machine
 Learning techniques that combine large
 neural networks (millions of free
 parameters), high performance computing
 (thousands of processors running in
 parallel), and Big Data (e.g. millions of
 color images or recorded chess games).
- Deep Learning is revolutionizing perception of the world by software agents (vision, voice, natural language, etc), and is now beating humans at many of these tasks.
- Deep Learning is also supercharging capabilities of industrial and consumer robots, as well as autonomous vehicles, since perception is crucial to embodied AI.

A Bit of History Steam Engine Amplified Our Muscle



Population explosion after steam engine was introduced*



- This enabled simultaneous rapid developments in mechanical engineering, chemistry, metallurgy, electricity, etc.
- The result was an **explosion** in both human population and human social development.
- The Industrial Revolution ushered in humanity's **first machine age**: for the first time our progress was driven almost entirely by technology, rather than biology.
- That technology was easy to copy, which caused rapid globalization on top of rapid technological development.
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[•] James Watt's **steam engine** introduced in 1775 allowed humans to overcome the limitations of muscle power with mechanical power.

^{*} Source: Erik Brynjolfsson. Second Machine Age.

A Bit of History Now AI is Amplifying Our Intelligence





- We live in an age of **paradox**. Systems using AI match or surpass human-level performance in more and more domains, yet measured productivity growth has declined by half over the past decade, and real income has stagnated since the late 1990s.
- Our solution to this productivity paradox is to leverage a different flavor of AI called IA, or Intelligence Amplification, invented along with the now-forgotten science of **Cybernetics** by Norbert Wiener and Ross Ashby in the 1940s.

This investment thesis is effectively a long exposure to productivity gains resulting from innovation in Al.

What's Ahead in Machine Learning Generative Adversarial Nets (GANs)



GAN architecture



Portrait painted by a GAN and sold at Christie's for \$432,000

GANs were invented by lan
Goodfellow, and they pit one neural net against the other, which teaches
them to create worlds eerily similar
to our own in any domain.

- Yann LeCun, Facebook's chief Al scientist, has called GANs "the coolest idea in deep learning in the last 20 years."
- Another Al luminary, Andrew Ng, the former chief scientist of China's Baidu, says GANs represent "a significant and fundamental advance" that's inspired a growing global community of researchers.

What's Ahead in Machine Learning



Reinforcement Learning architecture



Only 40 days to achieve superhuman performance

- DRL is **the most general purpose** of all learning techniques and requires less data than other techniques to train its models.
- DRL can be trained via
 simulation, which eliminates the need for labeled data entirely.
- Google DeepMind's AlphaZero started off knowing nothing about the game of Go and achieved superhuman level in 40 days.

What's Ahead in Machine Learning Self-Supervised Learning (SSL)





- Predict any part of the input from any other part.
- Predict the future from the past.
- Predict the future from the recent past.
- Predict the past from the present.
- Predict the top from the bottom.
- Predict the occluded from the visible
- Pretend there is a part of the input you don't know and predict that.

Self-Supervised Learning architecture

- Yann LeCun believes that Self-Supervised learning is the future of Machine Learning:
- Supervised Learning works but requires too many samples.
- Model-Free **Reinforcement Learning** works great for games, but requires too many trials in the real world. Anything you do in the real world can kill you. Plus, you can't run the real world faster than real time.
- The **SSL** idea idea is to train very large networks to **understand the world through prediction**.
- **SSL** networks will be much larger than today. We have unlimited amounts of data to train them. They will have sparse activation.
- Open question: Can electronic hardware take advantage of sparse activations?

What's Ahead in Artificial Intelligence **Deep Learning is Only The Start!**





Connectionists (Deep Learning)

reverse engineer the brain and are inspired by neuroscience and physics.

- Evolutionaries simulate evolution on the computer and draw on genetics and evolutionary biology.
- **Bayesians** believe learning is a form of probabilistic inference and have their roots in statistics.
- **Analogizers** learn by extrapolating from similarity judgements and are influenced by psychology and mathematical optimization.
- **Symbolists** view learning as the inverse of deduction and take ideas from philosophy, psychology, and logic.

Al ontology proposed by Pedro Domingos in "The Master Algorithm"

Who's Leading this AI Revolution? USA is Ahead of China (4x Lead)



The United States is in clear lead, followed by China. South Korea is at #7, ahead of Switzerland.

*Source: https://thundermark.medium.com/

Who's Leading this AI Revolution? Top 20 American Universities in AI



MIT, Stanford, CMU, and UC Berkeley are leading in AI research in 2021

Who's Leading this AI Revolution? Top Korean Leaders in AI Research

Korea Rank Global Rank	Organization	Score	Туре
1 15	KAIST	42.38	Academia
2 38	Seoul National University	20.64	Academia
3 75	Samsung	9.99	Industry
4 164	Yonsei University	3.73	Academia
5 178	Pohang University of Science and Technology	3.22	Academia
6 184	Korea University	3.10	Academia
7 198	Naver	2.77	Industry
8 199	AITRICS	2.71	Industry
9 217	Kakao	2.34	Industry
10 220	Chung-Ang University	2.33	Academia

Al Research Rankings 2021 for South Korea



Thank You and Please Stay in Touch!

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