

# Is “learning + random selection” fundamental in creativity?

— Way to my quest to Artificial Wisdom

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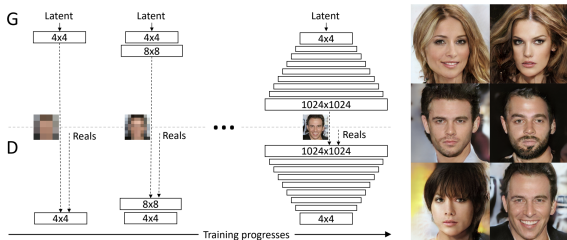
GSAIS (Shishu-Kan), Kyoto University

KU & GUL, 2nd Intl. Symp., March 16th 2019

Joint work with D.Ke, X.F.Liang, H.J.Liu, X.N.Lyu, S.Q.Yang  
& L.Zhang (artist)

# Project: Shanshui AI

- Tool: PGGAN (Karras et al, ICLR'18)
- Object: Shanshui (Chinese-style landscape paintings)



Pytorch implementation of PGGAN (<https://github.com/nashory/pggan-pytorch>)

# Shanshui has hamonious coexistence of nature and human.



山水画 - Wikipedia  
[ja.wikipedia.org](http://ja.wikipedia.org)



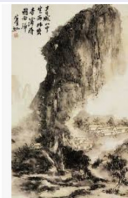
掛け軸 山水画 中国水墨山水画 …  
[item.fril.jp](http://item.fril.jp)



山水画 - Wikipedia  
[ja.wikipedia.org](http://ja.wikipedia.org)



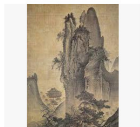
掛け軸華芳銘水墨山水画風景日…  
[jmt.y.jp](http://jmt.y.jp)



2019年の「349件のおすすめ…  
[pinterest.com](https://www.pinterest.com)



ヤフオク! - 口黄山海雲 中国 山水画 掛け軸 [9…  
[page.auctions.yahoo.co.jp](http://page.auctions.yahoo.co.jp)



四季山水図(春): 雪舟の山…  
[blog2.hix05.com](http://blog2.hix05.com)



2019年の「349件のおすすめ画像…  
[pinterest.com](https://www.pinterest.com)



水墨画の絵所四季 頂点に達した桃山期(桃山時代)…  
[edokoro.jp](http://edokoro.jp)



掛け軸紫峰銘水墨山水画風景日本画絹…  
[jmt.y.jp](http://jmt.y.jp)



墨絵ワークショップ「山水画2、木と水」 - JCE  
[japanculturalexchange.nl](http://japanculturalexchange.nl)



中国絵 朱雨洲山水画 - ヤフ…  
[page.auctions.yahoo.co.jp](http://page.auctions.yahoo.co.jp)



掛け軸 紫峰銘 水墨山水画 風景 日本画 …  
[item.fril.jp](http://item.fril.jp)

# Why and how we are doing this

## Background

- BS (Appl. Math) & BE (CS) from Tsinghua U (Beijing)
- Doctor of Informatics (Kyoto U)
- Research interests include algorithm, optimization, AI and related (i.e., model the world using math and computer)
- Lead an *Artificial Wisdom* research group at Shishu-Kan.

SDGs are popular in Shishu-Kan: no poverty, zero hunger, ...

What about after 2030?

## Hint from history

- Famine, plague and war were the three biggest threats in the past, but now the incidences of them is disappearing.
- Humanity's next (long-term) targets are likely to be Immortality, Happiness and Divinity (Y.N.Harari, Sapiens, Homo Deus).



## Divinity and future life

- Hint from Life 3.0 by M.Tegmark:
  - Life 1.0 can survive and replicate, e.g. bacteria.
  - Life 2.0 can design its own software, e.g., human.
  - Life 3.0 (the future life) can design its own software and hardware, e.g., upload, cyborg and superintelligence.
- Keyword is AI (M.Tegmark) or algorithm (Y.N.Harari).

## Observations

- Whether you like it or not, AI age is coming.
- Core value of humanity is shifting from physical to virtual.
- *Virtual* existence will be more and more important, until physical existence becomes nothing (important).

In fact, GAFA (Google, Apple, Facebook and Amazon) and similar are trying to build virtual worlds, where we (our virtual agents, to be precise) are citizens, and they are Gods.

Why cannot we be Gods in the next world?

But, supposing you can, how do you design your virtual agent, e.g., as a virtual artist?

A hint from history is Darwin's theory of evolution, but it is not clear for virtual life.

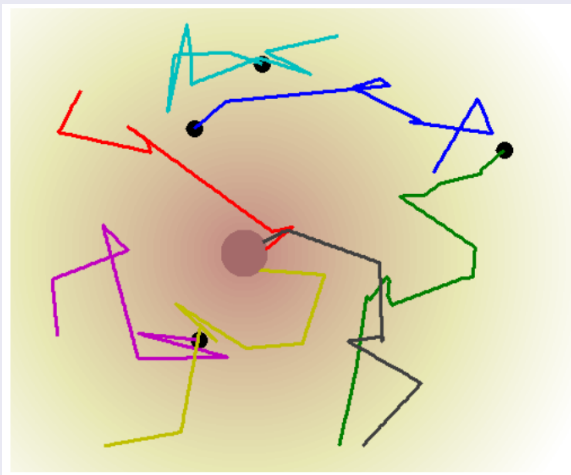
## My theory of (artificial) wisdom

- **Wisdom = Learning + Random selection**  
Wisdom is not the result, it is an action toward a result — the action consisting of learning (knowledge) and randomly selecting (under uncertain situations).
- Thus if you want to create a virtual life but don't know how, then equip him/her with some initial knowledge (like the DNA), give him/her the ability of learning and the freedom of choosing, then let him/her evolve.

# Evidences



# Life with no learning ability is not wise



[http://www.mit.edu/~kardar/teaching/projects/chemotaxis\(AndreaSchmidt\)/finding\\_food.htm](http://www.mit.edu/~kardar/teaching/projects/chemotaxis(AndreaSchmidt)/finding_food.htm)

## Brave choices in innovation

“(CNN Money) — Apple CEO Tim Cook ... telling the students to make brave choices, rise to challenges and be unafraid to break with conventional wisdom.”

— CBS SF Bay Area, May 14, 2018

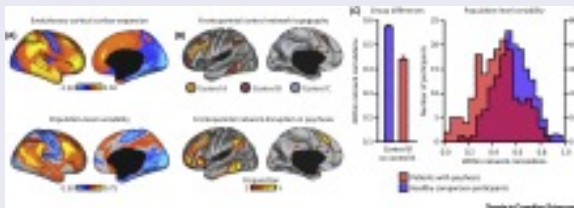


[https://youtu.be/Jr4LC1q1N\\_g](https://youtu.be/Jr4LC1q1N_g)

# Diversity in human behavior

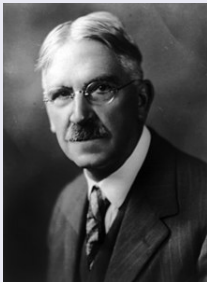
“We ... arguing that there is no universally optimal profile of brain functioning. The evolutionary forces that shape our species select for a staggering diversity of human behaviors.”

— A.J.Holmes and L.M.Patrick, “The Myth of Optimality in Clinical Neuroscience,” Trends in Cognitive Sci., 22 (3), 241–257, March 2018



[https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613\(17\)30268-1](https://www.cell.com/trends/cognitive-sciences/fulltext/S1364-6613(17)30268-1)

# John Dewey's education theory



[https://en.wikipedia.org/wiki/John\\_Dewey](https://en.wikipedia.org/wiki/John_Dewey)

Did Dewey realize the nature of his experimental education is learning + random selection?

## Mutation in society (another topic)



<http://www.patriotinstitute.org/end-second-american-era/>

## A recent and virtual (!) evidence

“... These deep neural networks are trained by a novel combination of supervised learning from human expert games, and reinforcement learning from games of self-play. Without any lookahead search, the neural networks play Go at the level of state-of-the-art Monte Carlo tree search programs that simulate thousands of random games of self-play. We also introduce a new search algorithm that combines Monte Carlo simulation with value and policy networks...”

— “Mastering the game of Go with deep neural networks and tree search,” S. Silver et al, Nature, vol. 529, 484-489 (28 January 2016)

*(LZ) Though they published it on Nature, the authors did not realize the nature of their algorithm, otherwise the title should use “learning” instead of “neural networks” and add “Monte Carlo” before “tree search”.*

## Summary: my quest to wisdom

- Life with no learning ability is not wise; Life with learning ability but no freedom of choice is machine or robot, also not wise. I quest “learning + random selection” is wise.
- “I can see any failure as a chance.” — S.Yamanaka
- “This ability to speak about fictions is the most unique feature of Sapiens language.” – Y.N.Harari
- “Einstein was wrong when he said ‘God does not play dice’. Consideration of black holes suggests, not only that God does play dice, but that he sometimes confuses us by throwing them where they can’t be seen.” — S.Hawking

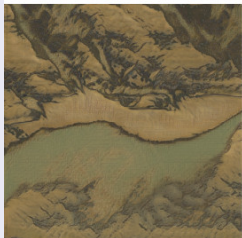
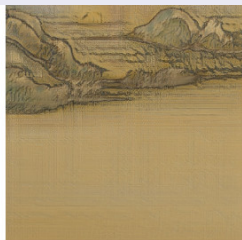


## My first step to challenge it: Art AI

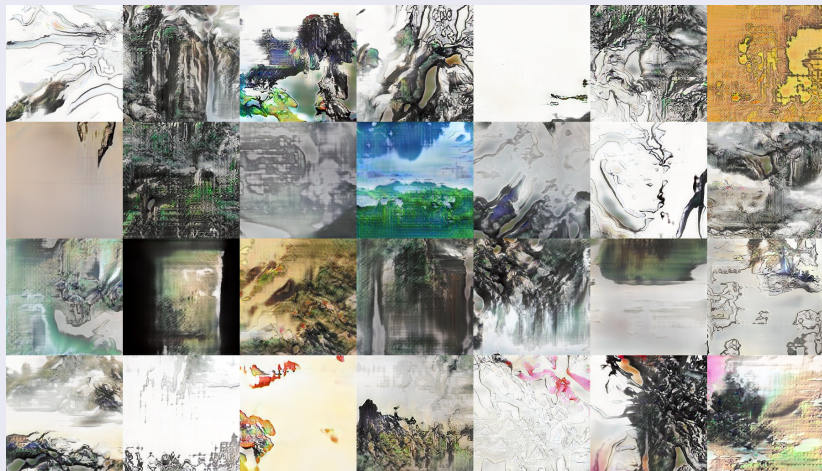
- Is it fundamental in creativity?
- Method: train a deep neural network by PGGAN, then generate image from a random (Gaussian) noise.
- Training set: one from Taipei National Palace Museum (949 images); another from Internet (2910 images).
- Size of output image:  $256 \times 256$  pixels
- Training time: 2 to 3 weeks with 2 NVIDIA 1080Ti GPUs.



## Generated raw images by the first training set



## Generated raw images by the second training set



## Painting by L.Zhang from one of AI-generated images



## Conclusion

- First, Shanshui AI needs improvement, but “Learning + Random selection” looks promising.
- In the study of AI, we need to consider on not only learning but also random selection.

## Future plan

- Study in more detail about the model to combine learning and random selection in creativity (wisdom).
- Study on the design of virtual agents and virtual world.
- Study on human from the above observations.
- Find more collaborations and supports...