Is “learning + random selection” fundamental in creativity?
— Way to my quest to Artificial Wisdom

Liang Zhao <liangzhao@acm.org>
http://aw.gsais.kyoto-u.ac.jp/liang/

GSAIS (Shishu-Kan), Kyoto University

KU & GUL, 2nd Intl. Symp., March 16th 2019
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 harmonious coexistence of nature and human.
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
“(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
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.”


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


(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

https://toyokeizai.net/articles/-/49464
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 × 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

<table>
<thead>
<tr>
<th>Image 1</th>
<th>Image 2</th>
<th>Image 3</th>
<th>Image 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image 5</td>
<td>Image 6</td>
<td>Image 7</td>
<td>Image 8</td>
</tr>
<tr>
<td>Image 9</td>
<td>Image 10</td>
<td>Image 11</td>
<td>Image 12</td>
</tr>
<tr>
<td>Image 13</td>
<td>Image 14</td>
<td>Image 15</td>
<td>Image 16</td>
</tr>
<tr>
<td>Image 17</td>
<td>Image 18</td>
<td>Image 19</td>
<td>Image 20</td>
</tr>
<tr>
<td>Image 21</td>
<td>Image 22</td>
<td>Image 23</td>
<td>Image 24</td>
</tr>
<tr>
<td>Image 25</td>
<td>Image 26</td>
<td>Image 27</td>
<td>Image 28</td>
</tr>
</tbody>
</table>

(AW Group @ KU)
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 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...