

BMI Machine Conscious Learning Project

Ever since humankind came into being, holistic mechanisms of Natural General Intelligence (NGI) and Artificial General Intelligence (AGI) have been elusive. For example, the Third World Science and Technology Development Forum Nov. 6-7, 2021 published “The Ten Scientific Problems for the Development of Human Society for 2021”. The No. 1 Problem in the information domain is “what are the mechanisms for human brains to process information and for generating human intelligence?” Many machine learning experts hoped that NGI and AGI can be modeled by, or achieved by, training increasingly larger neural networks on increasingly larger data sets that are static, like well-known projects AlphaGo [1], [2], AlphaZero [3], AlphaFold [4], [5], the IBM Debater [6] and many other similarly large neural network projects elsewhere. Unfortunately, such approaches are categorically hopeless for AGI, not only because of the alleged Post Selection protocol flaws [7], [8] but something much deeper and more fundamental. The recent discovery of Conscious Learning by Weng 2022 [9], [10] revealed a surprising principle, namely consciousness is recursively necessary across every time instant of learning by humans and machines in order to reach their NGI and AGI at each corresponding mental age.

Consciousness, in the full sense as we know it and defined in dictionaries, will never arise as an outcome of feeding static data sets, regardless of how large the data sets are and what kinds of neural network we use. But instead, consciousness is a necessary capability of a learner, natural or artificial for NGI or AGI, so that conscious thinking takes place while the learner processes information while learning across space and time on the fly. Weng proposes that the algorithmic theory of Conscious Learning in [9], [10] supported by the Developmental Networks is the first holistic solution to the above No. 1 Problem in the information domain.

Therefore, GNI appears to be computationally modeled and AGI seems to be machine achievable.

The remaining challenges toward modeling NGI and achieving AGI are still great but exciting. They include education of Conscious Learning theory and algorithms; research on hardware design for real-time, brain size Conscious Learning; development of practical Conscious Learning products; and applications of Conscious Learning theory and algorithms.

BMI, the Brain-Mind Institute, is pleased to announce a funded Project, called BMI Machine Conscious Learning Project, for all those who are interested. This announcement calls for professors, graduate students, and undergraduate students to apply for an appropriate position in the Project. The open positions include the following three categories:

- 1) **Research advisors:** There are four categories, assistant professors, associate professors, full professors and retired professors, corresponding to your current rank. The responsibilities include advising local students. It is desirable that each professor recruits a few of his students locally. Send your CV to BMI with the names, affiliations and contact information of the students who will submit applications in association with you. Each BMI paid student will correspond to a part of budget for his research advisor.
- 2) **Graduate students:** There are two categories, PhD program and MS program. Each student is expected to spend 10 hours each week during his university semesters and 40 hours each week during summer. The student’s time spent on the projects will be paid by BMI at a rate suited for his own country. Each applicant should identify a local research advisor who supervises the project on a weekly basis. If you are a graduate student in a university and are interested in applying for the Project, find a professor in your local university who can supervise you. Ask him to jointly apply for a professor position at the Project. You two should name each other in the applications. Send your CV and official transcripts during the undergraduate years and the graduate years.
- 3) **Undergraduate students:** There are four categories, freshmen, sophomore, junior and senior, corresponding to your year in your home university. Other requirements are similar to the Graduate

student category.

Admission terms: summer session 2022 or fall 2022. Specify your preferred starting summer date and fall date, as each country has a different date.

Send your filled application form, your application and supporting material to juyang.weng@gmail.com with a subject: Application: BMI Machine Conscious Learning Project.

Important dates:

January 22, 2022: Deadline for application

Feb. 15, 2022: Notice of admission

For further detail and questions, contact juyang.weng@gmail.com.

REFERENCES

- [1] D. Silver, A. Huang, C. J. Maddison, A. Guez, L. Sifre, G. van den Driessche, J. Schrittwieser, I. Antonoglou, V. Panneershelvam, M. Lanctot, S. Dieleman, D. Grewe, J. Nham, N. Kalchbrenner, I. Sutskever, T. Lillicrap, M. Leach, K. Kavukcuoglu, T. Graepel, and D. Hassabis. Mastering the game of go with deep neural networks and tree search. *Nature*, 529:484–489, January 27 2016.
- [2] D. Silver, J. Schrittwieser, K. Simonyan, I. Antonoglou, A. Huang, A. Guez, T. Hubert, L. Baker, M. Lai, A. Bolton, Y. Chen, T. Lillicrap, F. Hui, L. Sifre, G. van den Driessche, T. Graepel, and D. Hassabis. Mastering the game of go without human knowledge. *Nature*, pages 354–359, 2017.
- [3] D. Silver, T. Hubert, J. Schrittwieser, I. Antonoglou, M. Lai, A. Guez, M. Lanctot, L. Sifre, D. Kumaran, T. Graepel, T. Lillicrap, K. Simonyan, and D. Hassabis. A general reinforcement learning algorithm that masters chess, shogi, and go through self-play. *Science*, pages 1140–1144, 2018.
- [4] A. W. Senior, R. Evans, J. Jumper, J. Kirkpatrick, L. Sifre, T. Green, C. Qin, A. Zidek, A. W. R. Nelson, A. Bridgland, H. Penedones, S. Petersen, K. Simonyan, S. Crossan, P. Kohli, D. T. Jones, D. Silver, K. Kavukcuoglu, and D. Hassabis. Improved protein structure prediction using potentials from deep learning. *Nature*, 577:706–710, 2020.
- [5] J. Jumper, R. Evans, A. Pritzel, T. Green, M. Figurnov, O. Ronneberger, K. Tunyasuvunakool, R. Bates, A. de A. Potapenko, A. Bridgland, C. Meyer, S. A. A. Kohl, A. J. Ballard, A. Cowie, B. Romera-Paredes, S. Nikolov, R. Jain, J. Adler, T. Back, S. Petersen, D. Reiman, E. Clancy, M. Zielinski, M. Steinegger, M. Pacholska, T. Berghammer, S. Bodenstein, D. Silver, O. Vinyals, A. W. Senior, K. Kavukcuoglu, P. Kohli, and D. Hassabis. Highly accurate protein structure prediction with AlphaFold. *Nature*, 596(7873):583–589, 2021.
- [6] N. Slonim, Y. Bilu, C. Alzate, R. Bar-Haim, B. Bogin, F. Bonin, L. Choshen, E. Cohen-Karlik, L. Dankin, L. Edelstein, L. Eindor, R. Friedman-Melamed, A. Gavron, A. Gera, M. Gleize, S. Gretz, D. Gutfreund, A. Halfon, D. Hershcovich, R. Hoory, Y. Hou, S. Hummel, M. Jacovi, C. Jochim, Y. Kantor, Y. Katz, D. Konopnicki, Z. Kons, L. Kotlerman, D. Krieger, D. Lahav, T. Lavee, R. Levy, N. Liberman, Y. Mass, A. Menczel, S. Mirkin, G. Moshkovich, S. Ofek-Koifman, M. Orbach, E. Rabinovich, R. Rinott, S. Shechtman, D. Sheinwald, E. Shnarch, I. Shnayderman, A. Soffer, A. Spector, B. Sznajder, A. Toledo, O. Toledo-Ronen, E. Venezian1, and R. Aharonov. An autonomous debating system. *Nature*, 591(7850):379–384, March 18 2021.
- [7] J. Weng. Post-selections in AI papers in Nature since 2015 and the appropriate protocol, July 24 2021. <http://www.cse.msu.edu/~weng/research/2021-06-28-Report-to-Nature-specific-PSUTS.pdf>, posted on connectionist@cmu Dec.13, 2021.
- [8] J. Weng. Post selections in AI papers in Science since 2015 and the appropriate protocol, Dec. 13 2021. <http://www.cse.msu.edu/~weng/research/2021-12-13-Science-AI-Papers-Post-Seleciton-Protocol.pdf>, Posted on connectionist@cmu Dec.13, 2021.
- [9] J. Weng. 3D-to-2D-to-3D conscious learning. In *Proc. IEEE 40th International Conference on Consumer Electronics*, pages 1–6, Las Vegas, NV, USA, Jan. 7-9 2022. <http://www.cse.msu.edu/~weng/research/ConsciousLearning-ICCE-2022-rvsvd-cite.pdf>.
- [10] J. Weng. An algorithmic theory of conscious learning. In *2022 3rd International Conf. on Artificial Intelligence in Electronics Engineering*, pages 1–10, Bangkok, Thailand, Jan. 11-13 2022. <http://www.cse.msu.edu/~weng/research/ConsciousLearning-AIEE22rvsvd-cite.pdf>.