

Neuromorphic Technology

NEUROTECH



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Workshop report on elaboration of statements about ethical issues and threats of NCT enabled AI

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1 Executive Summary

Neuromorphic Computing Technology (NCT) has the potential of revolutionizing some aspects of the world's industry and economy and thus the ethics of the creation and usage of such technology is very important to consider at the research and development stage. We have discussed the impact and implications of NCT in the ethics workgroup of the consortium and here, we report on the summary of our discussions.

2 Introduction

As Machine Learning (ML) produces more and more impressive results with human-level performance in recognition and reinforcement learning tasks, the ethics of Artificial Intelligence (AI) becomes an important topic that the community of the researchers need to consider. The ethics of AI can be looked at from multiple fronts going from "trustworthy machines" all the way to the implications it will have in the economics and job markets.

NCT aims to go even a step further and build hardware inspired by biological neural systems using various technological solutions. This technology will revolutionize the field of AI since it provides orders of magnitude more power-efficient real-time computing platforms for embedded cognitive processing. Therefore, the ethics becomes an even more important issue for consideration.

The European commission has already published a set of guidelines with regards to what constitutes Trustworthy AI. In this report, we will first describe how these guidelines prepared by the EU experts relate to NCT. We will then further report the goals, questions and discussions that have been held in the consortium about the ethics in NCT.

3 Trustworthy NCT

Trustworthy NCT should respect all applicable laws and regulations, as well as a series of requirements; specific assessment lists aim to help verify the application of each of the key requirements:

- Human agency and oversight: NCT systems should enable equitable societies by supporting human agency and fundamental rights, and not decrease, limit or misguide human autonomy.
- Robustness and safety: Trustworthy NCT requires algorithms to be secure, reliable and robust enough to deal with errors or inconsistencies during all life cycle phases of their systems. NCT aims to create hardware neural networks that can be configured to robustly achieve the desired behavior in an unreliable environment. In this respect, NCT explicitly addresses the robustness and safety as its major technical goal.
- Privacy and data governance: Citizens should have full control over their own data, while data concerning them will not be used to harm or discriminate against them. NCT provides the opportunity for the real-time processing of data at the sensor side without the requirement to store and send data to the remote clouds. As such, the privacy of the citizens' data will be much more protected as it is processed locally.
- Transparency: The traceability of NCT systems should be ensured.

- Diversity, non-discrimination, and fairness: NCT systems should consider the whole range of human abilities, skills and requirements, and ensure accessibility. The NCT strives to design low power smart electronics that will thus be energetically sustainable and thus cost-effective. As such, NCT can be widely used by a diverse community.
- Societal and environmental well-being: AI systems should be used to enhance positive social change and enhance sustainability and ecological responsibility. The ultra-low-power spiking NCT will be able to process sensory data using factors of 10x, 100x, or 1000x less energy than equivalent processing systems built using traditional computing methods, leading the way to a generation of sustainable and eco-friendly technologies for edge-computing and Internet-of-Things applications.
- Accountability: Mechanisms should be put in place to ensure responsibility and accountability for NCT systems and their outcomes. NCT will produce a specific component for AI systems which carries out sensory processing and can learn to take local sensory-motor/action decisions based on sensory-inputs and internal states. The part of the system that will be trained to create these sensory-motor mappings can be audited by having full access to the system description and the data-sets used to train the networks developed.

4 Goals

The ethics work group will try to involve Ethics experts and philosophers and visionaries of AI with researchers on NCT to support formulation of strategies to enable sustainable future for technology. The ethics workgroup has hold a workshop and has discussed the goals and questions of concerns with regards to the ethics of Artificial Intelligence.

1. Involve ethics experts, philosophers, visionaries of AI and media.
2. Formulate strategies to enable a sustainable future for technology.
3. Provide input to and approve the Ethics statement document (to be published as a blog).

In this frame of thought, the questions that the workgroup would like to answer are as follows:

1. What are the areas of ethical concern in NCT?
2. What are other AI/NCT ethics interest groups around the EU (and beyond)?

5 Discussion

The ethics workgroup discussed the sustainability implications of NCT in terms of ecological concerns; The NCT research community has to come up with rules to keep public opinion on NCT on the positive side. In this context, the ethical concerns specific to NCT which is different from the mainstream AI include:

1. Protection by the means of disconnecting the power is more difficult.
2. Compared to mainstream AI, the NCT is a lot more low-power and autonomous. Thus, it is more difficult to shut down.
3. In case of using NCT for brain implants, how does one shut it down if they stop working?

4. We need to define specific rules of different types for NCT which specify red lines for the technology that everyone could agree on.
5. The potential of NCT for a fully autonomous agent raises some concerns on how to control this. Therefore, some element of user control should remain to ensure the safety of the users.
6. There will be concerns on the existing of autonomous weapons enabled by NCT. For example, small autonomous drones can have increased intelligence from NCT. We need to define and stick to rules which avoids situations like this.
7. Compared to AI, NCT enables edge processing, which can be inherently privacy preserving since data can stay local.

6 Conclusion

As a community, we need to try to classify applications in three categories of unethical, ambiguous and ethical. We also need wider NCT and AI ethical groups that brings everybody's attention to these ethical concerns. Most importantly, we need experts to advise technologists on the implications of this kind of technology on the general well-being of humanity.