Aim

The conference is intended to take stock of relevant research supported by the European Research Council (ERC), to provide a forum of networking between Principal Investigators leading ERC-funded project, and to position ERC as contributor to Artificial Intelligence (AI) through its 'bottom up' approach.

More specifically, it has the following aims: 1) to explore the state of the art of research related to AI; 2) to get a better understanding of likely benefits and potential threats of ever improving AI; 3) to highlight potential avenues how to seize the opportunities of AI whilst limiting negative effects for humanity.

Background

Although definitions of Artificial Intelligence vary greatly, they usually refer to cognitive abilities exhibited by machines such as problem-solving or learning which result in behaviour that is commonly associated with human behaviour. Through recent advances in applications of AI such as autonomous driving, social robots and automated medical diagnosis, this area of study has received considerable attention not only among scientists, but has also resonated with policy makers, entrepreneurs and society at large.

As with all novel and potentially ground-breaking developments, the expectations connected with AI range from great optimism about the potential positive impact of technological progress to fears about how intelligent machines may harm societies. Although there is divergence as to the nature of the impact - given the improved capabilities of AI - there is a wide consensus that the technologies and concepts linked to AI will profoundly change the world as we know it today. A successful transition to a society where many important areas will be changed by the use of AI will require addressing the undoubted challenges lying ahead, but also to ensure that we can seize very promising opportunities for Europe and beyond.

As a result, explorations into the transformative potential of AI applications are taking place at all levels. The French government, for example, presented a report in March 2018, which summarizes the state of the art and future trends. Taking into account the wide implications of the developments at hand, this report does not only focus on the national level but includes a European dimension. Similar activities are taking place in other European countries, such as Germany where the government is currently developing a strategy, with the aim to present it to the public at the Digital

Summit 2018 on 3-4 December. This kind of analysis and strategic planning is proceeding all over the world, reinforcing the sense of urgency associated with the potential benefits of establishing a strong position in AI development. Also, the European Union is tackling the issue head-on: not least because a report by the European Political Strategy Centre (EPSC) found that "It is widely expected that the next wave of innovation – in deep tech, Artificial Intelligence and robotics – will play to Europe’s strength in science, engineering and industry." In order to use these strengths to maximum effect, the European Commission released a communication in April 2018 which highlighted the need to join national efforts in a robust European framework allowing the EU to become a leader in what could be a revolution. Specifically, three important goals have been identified: boosting the EU's scientific base, technological and industrial capacity, preparing for socioeconomic changes and ensuring an appropriate ethical and legal framework. To support the implementation of the EU’s strategy in this area, a High-Level Expert Group on Artificial Intelligence comprising representatives from industry, civil society, as well as academia has been established.

Connecting to these efforts, the European Research Council Executive Agency (ERCEA) is devoting its annual conference to Artificial Intelligence. With its focus on scientific excellence and its 'bottom-up approach' where scientists freely choose the subject they would like to study, the ERC is in a prime position to contribute to a broad discussion on AI at the frontier of knowledge. The conference will bring together leading scientists from Physics and Engineering, the Life Sciences as well as Social Sciences and Humanities who are funded by the ERC. Each will briefly present their project and link their work to one of five thematic sessions as well as to opportunities and challenges of AI more broadly. The intended result is a broad, selective overview on the state of the art of frontier research which seeks to contribute to ongoing discussions on how to shape Europe's future amidst rapid technological change.

**Structure**

The conference will be organised in 6 sessions:

1. **Opening Session: Why Artificial Intelligence matters**
   This opening session will introduce the concept of Artificial Intelligence, its relevance in the EU and broader context, and will make the link between Artificial Intelligence and the ERC bottom-up funding approach.

2. **Foundations of Artificial Intelligence**
   Machine learning, neural networks and data science are key terms in the study and development of Artificial Intelligence. This session will address underlying concepts and groundwork that is being done by ERC Grantees for AI to unfold its full potential. How do key concepts such as rationality apply to AI? Where are the limits of supervised machine learning in terms of scalability

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and adaptability? And what about unsupervised learning: can robots overcome their limitations in dealing with new situations in unconstrained settings? New types of algorithms and software architectures open new areas of opportunity for big-data to make an impact. But what are the challenges of a transition towards a data-driven way of running society, business and science.

3. **Artificial Intelligence and the brain**

On the one hand the study of the brain has informed the development of AI in important ways; on the other hand newly-won AI capabilities have advanced our understanding of brain processes tremendously. This session will explore this inter-relationship at different levels starting from low-level sensorial motor processes to highly complex cognitive processes such as consciousness. Is there even a possibility that the human brain and Artificial Intelligence may be connected in the future in order to alter our sensory experiences? How might the brain support wearable technology? What conditions are necessary for a person to experience an artificial limb as part of their body?

4. **The Ethics of Artificial Intelligence**

This session will begin with an overview on the many challenges presented by the increasing implementation of AI in science and our society more generally. Social robots are employed more frequently but little is known about the interaction with humans. Should we attribute mental states such as beliefs or intentions to artificial agents or not? And if we decide not to, how will robots work in social situations where interaction is important? ERC Grantees are also investigating the potential of brain-computer interfaces to erase negative memories during sleep which may be helpful in treating post-traumatic stress disorders. Of course this raises questions under which circumstances this should be allowed and what possible side effects could occur. Robots may soon be able to take over important tasks in caring for the elderly which may be perceived as good news for Europe's social systems under strain. Still, how would that affect elderly persons that would interact on a daily basis?

5. **Apply AI: vision, mobility, language and science**

Moving even further into the realm of AI usage, this session will highlight latest developments in some of the major applications of Artificial Intelligence. How can we make the next leap in performance of automatic face recognition? What should a standard platform shared by car makers look like that could be used for next generation intelligent vehicles? How can we use large-scale semantic AI to concentrate centuries of deep human thinking in a computer-understandable form and thereby learn more about how humans do mathematics and science?

6. **Artificial Intelligence and Society: where are we headed?**

This session will feature ERC projects that examine the use of Artificial Intelligence in key societal areas such as politics, culture, education and healthcare. The use of low-level AI specifically around elections to influence political opinion has caught the attention of science and media alike. Is Artificial Intelligence employed by political groups making a decisive impact on who governs Western democracies? As mentioned, social robots are on the rise – initially originating from Japan and other Asian countries – one ERC Grantee does wonder how much Japanese culture is built into new companion robots? Some of those robots are currently tested for their use in educating primary school children – what will be the impact on these – quite literally –
early adopters? AI and big data will also change how we diagnose illnesses and could thus have major benefits. The conference will thus hear about the potential of machine learning for much improved diagnostic capabilities in the case of typ1 diabetes.

Closing remarks

ERC President Jean-Pierre Bourguignon will conclude the conference with first impressions of the rich programme and lessons learnt. This will provide the basis for a short conference report on "Frontier Research and Artificial Intelligence" that can feed into the ongoing AI discussion on a European and global scale.

Target audience / participants (in addition to invited speakers)

a) Representatives of EU-wide and national research organisations
b) Individual researchers
c) ERCEA interested staff and interested colleagues in other EU institutions
d) Industry and other interested stakeholders