8 Days at ICA 4 First session in Paris

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ABSTRACT

This 4th edition of the ICA hosted by the Paris Institute for Advanced Studies (Paris IAS) from October 18 to 27, 2021, expl interdisciplinary issues at the intersection of cognitive science, neuroscience and artificial intelligence. Decisive advances h the last decades in the analysis of brain activity and its behavioral counterparts, as well as in information processing scienc complementarities between neuroscience/cognitive science and artificial intelligence allow us to explore synergies and raise between these disciplines, which present considerable challenges and opportunities for the progress of society.

Introduction

The Intercontinental Academia (ICA) creates a global network of future resea which some of the very best young academics work together on paradigm-s disciplinary research, mentored by eminent researchers from across the globe.

The ICA was established in 2016 through the University-Based Institutes for A (UBIAS) coalition which has 44 member institutes around the world.

During each edition of Intercontinental Academia, participants get together in over the course of one year.

Previous editions of ICA have focused on "Time", "Human Dignity" and "Laws Dynamics".

The 4th edition of the ICA explores the complementarities between artificial ir neuro/cognitive-science and the tremendous challenges and opportunities t humanity. Fellows and mentors initially met online and in cyberspace, and now Paris, from October 18 to 27. They shall meet again in cyberspace in the next fe then finally, in Belo Horizonte in Brazil next June.

The first session, hosted by Paris Institute for Advanced Study (Paris IAS), inclu 10-days of scientific sessions, discussion forums as well as scientific exchang Paris Saclay, Sorbonne Center for Artificial Intelligence and Ecole Normale Supé

Each day at the Paris IAS, ICA4 Fellows meet with their Mentors for a closed 3
during which two mentors launch the discussion with a presentation. Upon con
seminar, the Fellows then meet for 45 minutes to list the key takeaways and i
emerged from the discussion, followed by a collective brainstorming session
that the output of collective intelligence is collected, formatted and capitalised.

The other half of the day is left free for participants to reflect on the scientific
small groups. Such discussions are occasionally complemented by lectures from

Day 1: "The future needs wisdom!"

The very first lecture of ICA4 - Session 1 came from *Robert Zatorre* who to
fascinating world of music while explaining the relationship between perceptio
and pleasure!

This was followed by another lecture that introduced a rather different perspect
was presented by *Eliezer Rabinovici*. The lecture mostly explored the complexiti
enquiries and methods in the context of AI.

Before leaving for cocktails and welcome speeches in the chambers of Paris
lecture was given by*Helga Nowotny*, who emphasised an urgent need for
context-sensitive AI control system.

Perception, prediction, and pleasure: What can music tea
about neurocognition/intelligence?

Presented by ***Robert Zatorre***

It was stated during the seminar that the brain represents the properties of th
and guides behaviour through evaluation and reward. Aesthetic pleasure can be
phylogenetically older system that is centred on the striatum.

Moreover, results of the relation between connectivity of the auditory cortex wi
and several behavioural results were presented (e.g. related to amusia,
anhedonia). Dynamic causal modelling and predictive coding frameworks have l
as possible explanations of the relationship between learning and reward in mus
make the rewards evolve from a biological event to the expectation of the event.

Through the post-seminar collective discussions, the relevance of affecti
(pleasure and fear) in learning was emphasised. Discussions concluded with
ended question, leaving ICA4 Fellows wondering about whether or not AI
similar system for learning, and how should the reward and punishment be c

Maybe AI does not need to understand or experience human emotions; it just ne like a human by capturing the features of a dataset that correctly describes the be

High Energy Physics: Successes, Challenges and Magic

Presented by ***Eliezer Rabinovici***

It was discussed that observing natural phenomena can motivate scientific enq us to understand the unknown. Moreover, equations are a way to increase However, a single, compact and reductionist explanation for all phenomena in may not necessarily exist. The scientific method requires that results are repr correspondence principle requires that new theories can explain all phenomen preceding theory was valid. To understand a phenomenon, one has to identif players and determine the correct explanation scale.

In AI We Trust: Power, illusion and control of predictive algorithms

Presented by ***Helga Nowotny***

The session began with introducing the concept of singularity and defining i point: a change of state that can lead to the collapse of a system. In an atte Ethical AI, examples such as Transhumanism (ideas of transcending the limitatio body through information sharing) were discussed. Furthermore, the illusion t humans better than humans know themselves was elaborated, ultimately c mentioning the existence of a possibility for human beings to both profit or suff system depending on how it is applied.

"The future needs wisdom": an urgent need to institutionalise context-sensitivi creating a standardised system to control AI, was discussed and collectively de lead to further debates regarding the concentration of technology advance deteriorating impact on inequality. Thus, a global agreement is necessary t although it is currently almost impossible to obtain! Therefore, we should ed child of humanity that can grow to contribute to society. AI research is underta massive scale that it requires global efforts which go beyond a single country. paid by society, and their curiosity-led work should return to society as a whole.

Day 2: "In AI we trust"...or not!**

The ICA4 continued onto the second day, through which three seminars to mentors who had joined the first session in Paris from around the world!

The first lecture was by *Robert Aumann*, a Nobel prize laureate, who fo convoluted concept of consciousness and its counterparts.

This was followed by a lecture from *Karen Yeung*, who offered a rather critical on the prevalence of AI, as well as some of its surrounding myths and misco then went on to explain how responsibility should be re-defined to consider t impact(s) of AI in human societies.

Finally, Raouf Boucekkine took the fellows for an exploration into the world and finance, using the concept of equilibrium as an example to illustrate between disciplines: mainstream economics VS. statistical physics!

- Why Consciousness?

Presented byRobert Aumann

Essentially, the seminar was focused on the purpose which consciou Consciousness was defined as the ability to do the following:

- Perceive
- Feel (emotions)
- Think/intend
- Carry out intentions (volition)

Of all the above, perceiving, thinking/intending, and carrying out intentions ma machines. However, feelings and emotions belong exclusively to human bein context, it may be argued that the evolutionary function of consciousness is operation of emotions. This being said, we currently have no idea abo consciousness work. Although considerable progress has been made in AI, Artif (AE) has remained rather untouched.

Myths and misunderstandings about responsibility for th unintended impact of AI

Presented byKaren Yeung

The talk mostly focused on responsibility for the unintended impact of Artificia based on the presenter's Council of Europe study. It was argued that Machine Le capacity to enable task automation and machine "autonomy" raise important q responsibility. Thus, responsibility-relevant attributes of ML were identified, illustration is the data-driven profiling of individuals, and other ML applicatior hold adverse impacts on human rights, on both individual and collective levels.

While responsibility is important for human beings, who are considered as m maintain peaceful social co-operation within the community, only a few studies on tackling the fundamental role of responsibility for individuals, as well as the

The impacts produced by complex socio-technical systems using ML tech generated a range of concerns that fall under the heading of "algorithmic While existing laws have an important role to play in ensuring the acc algorithmic systems, the implications of these technologies for their interferenc rights need to be studied further. This has been the primary focus of Karen Yeun

In a nutshell, two dimensions of responsibility are required:

- Historic or retrospective responsibility: responsibility for conduct and events that occurred in the past
- Prospective responsibility: roles and tasks that look to the future

Finally, five common myths and misunderstandings concerning responsil unintended adverse impacts of AI were identified:

- Need for effective and legitimate mechanisms to protect human rights from AI applications.
- Identifications of the appropriate responsibility model for allocating, distributing and preventing the various threats and risks.
- Responsibility of states to ensure that these policy choices are made in a transparent and democratic manner, in order to effectively protec
- Need for more interdisciplinary research
- Application of the fundamental principle of reciprocity so as not to allow those who develop and run our advanced digital technologies a and exercise their power without responsibility.

Data science and deep learning vs theory: two examples economics and finance

Presented by ***Raouf Boucekkine***

The session included discussions on Data Science, Machine Learning (ML), and theories in the field of economics and finance that share common discip examples from macroeconomics, in which characteristics of the underlying m complex systems are of great interest, were then discussed in more detail. In s misunderstanding between different disciplines was highlighted: the concept of of great significance in mainstream macroeconomics, whereas this is not the cas physics (e.g., the "equilibrium" bias outside the econ area, discussed by Boucekkine (2020)). Finally, the use of various methods and approaches, s (Dynamic Stochastic General Equilibrium), ABM (Agent-Based Modeling) Network-Based methods, in the field of macroeconomics were discussed.

Day 3: "What you do FOR people, you do T people, so do it WITH people!"

Day 3 of the first session of ICA4 continued in Paris IAS, where the Fellows sat more scientific seminars, followed by discussions and brainstorming sessions.

The day kicked off by a framework proposed by *Saadi Lahlou*, called "Install which enables scientists to analyse and regulate human behaviour. This was con a new technique to capture the subjective perception of action, ultima psychological and behavioural sciences one step closer to what was once technically impossible task: introspection!

William Hopkins then joined the discussions with some stimulating videos from on apes, while exploring self-recognition and social cognition in animals.

Finally, Toshio Fukuda revealed the Moonshot project: a society where humans a together in 2050 !

Distributed Intelligence & Distributed Agency

Presented by ***Saadi Lahlou***

We want intelligence to perform relevantly adapted actions that change the situ we are for the better. To design intelligence, we must first understand the natur activity. In this sense, the behaviour was defined as what people do, seen from other words, behaviour remains an external description of objective phenomena. activity is how people subjectively perceive their action and how they see it fi perspective.

Installations consist of components that simultaneously support and control. In they are specific, local, and societal settings where humans are expected to beha e.g., airport, metro, cash machine, etc. Installations consist of three layers: affo physical environment, embodied competencies and social regulations. Intelli distributed over these three layers.

The question now is: why do we have these installations? Because installations of our behaviours and consequently make us very efficient, although our shor cognitive processing are very limited compared to animals. Installations are r redundancy produces resilience and learning.

Moreover, certain questions on designing trade-off issues were raised: whic whom? AI agent? what kind of competence for the AI? What affordances? Wha degree of awareness? To whom does the agent report? How is it evaluated? He

“privacy dilemma.” In other words, for better service, one must disclose inform an “agency dilemma”? Can we make it explicit? Because the agency is distr responsibility is shared. It means that we now have the “many hands" pı credentials for AI were suggested, which include values (what does it try ownership (who takes responsibility for its actions), principles of action (rule domain of awareness and action), track record (list of transactions executed, i training).

To conclude, ICA4 Fellows were left with some questions as food for thou activity, do we want to augment existing agents with more agency? If so, Humans? Material objects? Social system? New agents? Who learns what? Wha want to foster? What do we want AI for must be addressed for each activity, sta activity and discussed?

Perspective on Artificial Intelligence research from studi Agency, self-recognition and social cognition in animals

Presented by ***William Hopkins***

The session began by discussing humans constructed concepts to reflect intellect various domains of cognitive functions. In this sense, we use tests like the WA Binet to quantify and scale performance to standards for specific age classes. T heavily on language. There are many approaches to developing fair tests of cogı species with different sensory and motor capabilities. It began with Darwin and George Romanes (1884) focused on animal intelligence and later on, Kohler (19 learning. Within the same field, Robert Yerkes (1916) worked on “The mental li and apes: a study of ideational behavior”. Yerkes later developed the IQ test use in WW1 (army alpha test).

Upon drawing on some of the literature, several videos were played, in which a various tasks including retrieving a peanut in the bottom of a tube followed by an ape imitating a human, and so on. Several animals passed the mark test. E.g., a yellow stick in their neck can identify it and try to remove using the m parcellation of chimpanzee brain - compared to humans, the ones that passed differences in some cortices. Grey matter differences between MSR+ vs. MS analysed the anterior cingulate since such neurones are rather long and conne cingulate with the insula.

Moreover, results from studies that showed that human children outperforme social, but not physical, cognition tasks were presented and discussed. Much lik in AI, Most early comparative studies of cognition and intelligence were stro associative learning theory. However, associative or operant theories of learning notoriously anti-cognitive. In the 1960s, there were attempts to reach ap

communication systems. The goal of the ape language studies was to deter language is uniquely human. The answer depends on how we define language.

However, is it language? There is very little evidence for declarative production the TV, give me an onion) in communication signals by primates and other anim question is: are social stimuli rewarding? For chimpanzees, yes. Experiment: tou to see other chimpanzees or another button to see random animals. The chimp the button to see other chimps. Thus, the role of reward guides the learning and animals. Although animal cognition is often used to explain animal behaviour explained by an associative learning mechanism.

AI and Robots for Future: The Moon Shot Project

Presented by ***Toshio Fukuda***

Robots are avatars that pop up to help when humans need them. There is an in physical interaction between robots and humans. Toshio showed several mult e.g., monkey-type robots, multi-locomotion, intelligent cane, etc. One of these Brachiator I-III. Brachiation is a form of long-armed ape locomotion. It uses dy pendulum, under-actuated mechanical system, variable constraint system, mac AI, reinforce learning, soft computing (fuzzy, genetic algorithm). Regarding mu types, in many cases, one creature has multiple types of locomotion in order mobility. The motivation of their study is to develop a robot mechanism architecture that can achieve multiple locomotions. Hybrid computational intelli and brain interface were also commented upon by the speaker while showin related videos. An example of such videos illustrated the Boston dynamics atl three robots dancing and jumping which was quite impressive!

Moreover, AI+Robot+IoT (Internet of Things), the use of robots in mega- urbanisation, food, ageing, global warming, robot, and AI) were discussed. This by further discussions on autonomous cars, which may be safer than human reality, the Eve project (a transparent body that simulates the human body), cybo (fusion of robot and animal), and multiple robots (communication among robots)

Day 4: A visit to The University of Paris-Sa

The Fellows embarked on their first scientific trip for ICA4 and were hos
Normale Superieure de Paris-Saclay throughout Day 4. The sessions at Saclay
thought-provoking talks by *Xiao-Jing Wang* and ***Jay McClelland***, both of which
the principles underlying cognitive behaviours, as well as the difference betwe
machine intelligence. These were followed by a symposium on AI at University
The symposium was followed by a half-day event with multiple workshops i
mentors discussed major advances and issues surrounding AI with othe
researchers such as ***Stanislas Dehaene***. Finally, the intellectually intense day c
with a talk in which ***Zaven Paré*** raised important questions regarding how w
with AI algorithms and intelligent robotics in the decades to come…

Efforts to understand the computational principles under
cognition

Presented by ***Xiao-Jing Wang***

Deep neural networks, despite their recent success, differ from human cognitio
have no internal mental life - instead, they act as complex, nonlinear input-outpu
humans, the prefrontal cortex (PFC) is known to be crucial for cognitive fun
working memory, decision making, and executive function. An early avenue o
involved understanding how persistent neural activity may underlie workin
sustaining stimulus information in the brain after the sensory cue has disa
persistence is linked to recurrent connectivity, which is lacking in most deep n
described his previous research using spiking networks and tools from dynami
understand the attractor dynamics behind this form of memory. In the second h
he showcased his more recent work which uses recurrent neural networks (RN
of a model organism to probe how the PFC may perform multiple c
simultaneously. These RNNs can then be used to address questions such as wh
encodes cognitive building blocks in a compositional manner, similar to the
concepts of schema.

A different distinction between human intelligence and A

Presented by ***James McClelland***

While the latter (in particular machine learning algorithms) learns from statistics
input data, humans learn to learn from explanations structured by culturally inv
Indeed, humans fail to perform in systematic ways, which we would expect i
were built into our cognitive functionality. But, McClelland points out that simp
structure, as proposed by the pioneers of GOFAI, limits flexibility. This structu
argued, is built by culture. For example, he described a classic study by Scribn

1973 which showed that non-Western cultures often lack a concept of absolut tend to classify objects based on concrete situations rather than abstract categor These authors proposed that Western education creates a context in which c relational concepts are learned, consistent with McClelland's later work corre puzzle performance to mathematical education level. McClelland closed by reit learns by examples but humans learn by explanations and that his explanation- (rather than built-in structure) may underlie our propensity for one-shot learning.

Upon completion of the talks by ICA4 Mentors, Paris-Saclay hosted a half-d multiple workshops in which ICA4 mentors and Paris-Saclay researchers di advances and issues surrounding AI. *Stanislas Dehaene* presented a series of fM behavioural evidence that humans use symbolic and recursive strategies on p with complex sequences, as compared with monkeys which seem to use a strategy. In a session focusing on AI and ethics, *Paola Tubaro* revealed the workers who provide the hand-labelled training data for products such as Siri. companies and corporations needing a cheap workforce in the same langua reproducing historic colonial patterns.

Finally, the intellectually intense day came to an end with a talk in whic discussed his artistic works based on electronic marionettes and his collab robotics specialists in Japan. Paré's conception of automaton-centred the audiences while challenging our tendency towards anthropomorphisation. This ra questions regarding how we will interact with AI algorithms and intelligent r decades to come...