IJCAI-ECAI 2022: Can Europe Revive its Position in AI after Lagging Behind the US and China?
Subtitle: AI is dead, long live AI!

Editorial by Matjaž Gams

As the subtitle suggests, the old AI is dead, and a new AI is ascending the throne. Can IJCAI [1] provide us with answers about the new AI?

The joint IJCAI-ECAI 2022 conference with workshops was held at the Messe Center, with 55,000 m² and a capacity for 25,999 visitors in Vienna, Austria (see Figure 1), from the 23rd to the 29th of July. It was the 25th European Conference on Artificial Intelligence and the 31st International Joint Conference on Artificial Intelligence, making it the longest-running major conference series spanning all areas of artificial intelligence. It was the first in-person conference after the unfortunate COVID-19 period. This fact alone was enough to make it an exciting event, without even considering the advances highlighted in this editorial. The second central theme was the relative progress in AI made in China, the US and the EU.

Figure 1: In 2020, IJCAI-ECAI was held in Vienna, often described as the world's most livable city.

In recent years people have detected an ominous lag in European AI. For example, in 2021 the European Investment Bank [2] published a report on *Artificial intelligence, blockchain and the future of Europe* with the subtitle *"How disruptive technologies create opportunities for a green and digital economy"*. At that time Europe still had an upper hand in some categories, e.g., there were 43,064 AI researchers in Europe, plus 7998 in the UK, 28,539 in the US and 18,232 in China. However, while AI and blockchain technologies accounted for €25 billion in annual investments, 80% of that amount was covered by the US and China (€20 billion), and only €1.75 billion, or

7% of the investment, was from the 27 EU Member States. The report advises the EU to invest nearly €10 billion in blockchain and AI, to match the progress in AI in the other two superblocks. Similarly, scientific progress by the Chinese at IJCAI was observed [3].

These three blocks are well aware that AI is not only one of the most progressive scientific disciplines, it is also boosting the digital transformation across industries and societies at a global level. While the blocks are similarly concentrated on AI, their progress is very different. The US was – and still is – the leader in AI technologies; China has begun to catch up after a long period of delay; and the EU is a story on its own. In this period China has overtaken the US as the largest economy in terms of real GDP, i.e., PPP. Based on several metrics, the EU is currently positioned third, but with a clear potential to deliver on AI and catch up. The progress of the three blocks is also closely related to Brexit and the war in Ukraine, which has delivered a huge economic blow to progress in EU and a more modest one to the US.

Back in 2020 the EU recognized the importance of AI in Europe [4] and devoted reasonable funds to it. It also tried to forge its own way: towards trustworthy and human-centered AI. At IJCAI 2022 some researchers even claimed that the usual metrics are no longer relevant to the EU's AI since it is now differently oriented. On the other hand, some people are of the opinion that the EU diverted from the path of conventional research in the direction of social-sciences-oriented AI, which may on its own represent an additional obstacle to AI progress in traditional and technological ways. In [4], the overview concluded with "Europe needs to find a way to protect its research base, encourage governments to be early adopters, foster its startup ecosystem, expand international links, and develop AI technologies as well as leverage their use efficiently." Whatever the case, several reports about AI, similar to [4], conclude that "Disruptive technologies create opportunities for a green and digital economy".

Looking at search engines, we get an impression of the general relations. In this field, Google from the US and Baidu from China are not matched by an EU search engine. These companies not only use AI in every search, they also provide an intense top-class AI research. A decade and half ago the EU's approach to search engines resulted in a novel, distributed search-

engine concept based on genres [5], but as is typical with EU projects, after the research-project phase ended there were no funds to implement it in real life. In contrast, the Chinese (albeit with some issues related to democracy) promoted its own search engine, Baidu. By November 2013, Google's search market share in China had declined to 1.7% from its August 2009 level of 36.2%. Had the EU governments decided like the Chinese to actually implement ALVIS as its own search engine, it would be competing at the global level. Alternatively, the EU could buy a competing global search engine and adapt it to EU standards and needs. Unfortunately, and unlike the global fast-train initiative accepted recently, there is no EU initiative to setup a European search engine containing major AI elements.

In a report published in 2022 by the Joint Research Centre "AI Watch Index 2021" [6] the overall conclusion is that the US is the leading country in several categories, while Europe is in third place. For example, in terms of AI organizations (companies and institutions), the US has 14,000, China 11,000, and the EU 6,000. The report also observes an important reduction in AI activities in the EU due to Brexit. But while Europe is third, the gap is smaller than is often suggested. The European Commission is set to invest additional €1 billion per year in AI and bring overall EU spending up to €20 billion annually.

The report also contradicts the claims [2,3] that China is emerging as a world leader in AI. While China has experienced an explosion in the filing of patents, its innovative potential is kind of modest. Similarly, while in 2019 China accounted for 22.4% of the world's peer-reviewed AI publications, more than the EU (16.4%) and the US (14.6%), according to the Artificial Intelligence Index Report 2021 by Stanford University, and China overtook the US for the first time in AI journal citations, the major achievements still seem to remain related to the US. For example, 56% of China's top AI talents are employed in the United States. Nine out of ten Chinese students who studied in the field of AI in the US stayed on after graduation.

Back to IJCAI-ECAI. Would you expect one of the three top scientific journals to publish a paper about one of the year's AI achievements? It happened in the journal *Nature* in 2022 [7, 8], see Figure 2. Naturally, this achievement was presented and discussed at the conference during several events and subtasks, e.g., best lap, best overtaking, and similar. The catch is that the AI algorithm/method outcompeted human champions in the Gran Turismo racing game. In simple words – a program was driving better than the best human drivers. Another task where AI programs outperformed the best humans, but just consider how much this task is different from the previous ones solved by AI.

It is more or less common knowledge that AI outperforms humans at chess and formal games and tasks. At IJCAI-ECAI 2022, the world chess competition was going on with Ginko coming out the winner (see Figure 3). However, the main attraction was the car racing. Consider again the major difference between the two tasks, i.e., chess and driving a car, the latter dealing with sliding, breaking, and overtaking on the limit. Would you expect it a year ago? Where is the limit for AI?

Figure 2: AI outcompeted humans in a car racing game.

Figure 3: The computer chess championship was held at the conference, resulting in several astonishing games.

There were lots of "normal" papers dealing with regular issues. The research described in an IJCAI paper [9], and also in Figure 4, first fed the agents, e.g., with anti-vaccination videos and observed how they became anti-vaccines oriented. However, after watching debunking videos, on average the agents turned somehow "normal", but to different degrees in the five areas analyzed: 9/11, chemtrails, anti-

vaccination, flat Earth, Moon landing. The agents did not have human cognitive properties, they mainly performed an extraction from the input into their "beliefs". It is fascinating that agents as well as humans seem to have a low-level of free will and a resistance to information tampering. The effect of commercials, web advertising, recommendation systems, conventional media and the information overflow seems to increasingly change humans into "mental zombies". The expectation of the web's visionaries that the vast amount of information at hand on the Web and the possibility to cross-check anything will create humans who are more knowledgeable and cautious is, on the whole, failing. Increasingly, people are becoming trapped in their information bubbles, leading to dispute and hate between different political and ideological groups.
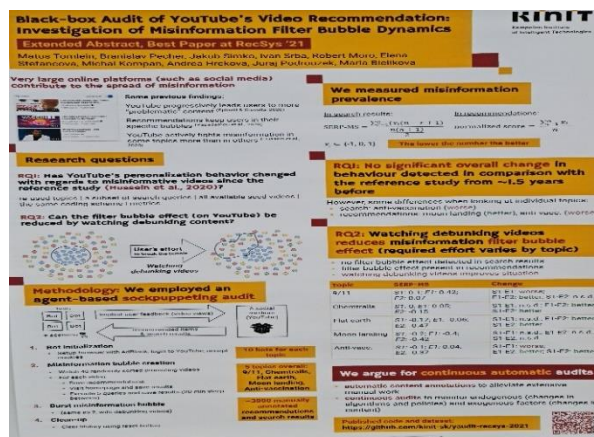

Figure 4: Agents demonstrate the power of YouTube information bubbles.

That paper also indicated how to deal with disinforming videos and other information sources: present quality debunking information that leaves no question. Years ago, scientists proposed Wikipedia as the main resource for human knowledge and truths, but unfortunately, even that top-quality source of knowledge in the form of an encyclopedia is becoming biased by radical ideologies. The main reason is that knowledge sources like Wikipedia or Quora started dealing with political issues, e.g., whether some action by President Donald Trump was legal or not. Such information has no place in quality scientific sources. Therefore, the current advice is to trust only factual data, and hold reservations and double check when dealing with political, ideological and subjective issues.

There was also a tutorial on opinion formation in social networks. Several models were explained, e.g., of De Groot, Friedkin-Jensen and similar. They enable a formal analysis of behavior, although it seems that some semantics is lacking to explain actual behavior.

But they enable a formalization, which is an important improvement in itself.

Another interesting area was automated story generation. From generation to generation, programs have improved their performance. There are several programs like GPT3, OPL, Lambda, Comet, etc. of which the public is probably aware of a couple. On average, they are not as good as humans, but the difference is shrinking fast.

It is worth pointing out that xGBoost and deep neural networks, which are now referred to as "neural networks" (since now they are all deep), compete for the best results in various domains. In one way, both methods are different, one relying on trees and the other on layers of neurons, but in another way they both exploit multiple/redundant knowledge, which is the source of their success.

Among the increasingly popular areas is federated learning, because it efficiently resolves anonymity problems. Among explanations, counterfactual reasoning provides the best ones – if only somebody could explain that to the bureaucrats.

The panel on career development concentrated on the differences between academia and industry. All over the world, salaries are larger in industry and risks higher, but academia is more open to new ideas.

Climate, oceans and environment deserved a special workshop at IJCAI.

Among the invited presentations, Gerhard Widmer, as usual, extracted the most passion from the audience, this time by introducing feelings into classical music. Luc Steels reminded us that AI is currently by far the most exciting field, and the one that will raise our society to the next level. Tim Miller analyzed explainable AI and showed that AI publications are slowly but surely moving from purely algorithmic/technical into the social and cognitive subfields. Pete Wurman explained how they won the world competition in the Gran Turismo racing game (see Figure 2). Jerome Lang presented an observation and vision of how AI is moving toward incorporating some social sciences using agent studies. Markus Hecher was the recipient of the EurAI dissertation award for an improvement in ASP by changing graph problems into trees. Sumit Gulvani from Microsoft Research explained his module for learning in Excel that is based on learning from a couple, one or even zero examples. Judea Pearl is no doubt one of the most famous scientists in probability and AI since he invented Bayesian networks. The key is in the causal inference. Unfortunately, time was too short to catch all his ideas. Michaela van der Schaar dealt with medical problems and emphasized the role

of time and explanation. SimpleEx is supposed to explain any black box in the form of an equation. Ana Pavia presented the engineering society and collaboration in AI systems. Bo Li introduced trustworthy ML. Michael Littman analyzed the decrease of complexity due to novel approaches. Stuart Russel presented an overview of AI development and potential future directions, and relations between AI and humans.

In summary, to attend IJCAI is to harvest the world's AI knowledge and to exchange ideas about future work. As such, IJCAI remains the premier AI conference in the world.

P.S. To demonstrate that we can and should do better in relation to the environment, a billboard promoting a grass field for insects in the center of Vienna is presented in Figure 5.

Figure 5: Vienna demonstrates that there is room for plants and insects in cities, symbolizing a new approach to the environment.

References

[1] IJCAI Proceedings, https://www.ijcai.org/past_proceedings

[2] Artificial intelligence, blockchain and the future of Europe, European Investment Bank, https://www.eib.org/en/publications/artificial-intelligence-blockchain-and-the-future-of-europe-report

[3] Gams, M., IJCAI 2018 - Chinese dominance established: editorial. *Informatica: an international journal of computing and informatics*, ISSN 0350-5596, 2018, vol. 42, no. 3, pp. 285-289.

[4] Brattberg, E., Csernatoni, R., Rugova, V., Europe and AI: Leading, Lagging Behind, or Carving Its Own Way? https://carnegieendowment.org/2020/07/09/europe-and-ai-leading-lagging-behind-or-carving-its-own-way-pub-82236

[5] Vedulin, V., Luštrek, M., Gams, M., Training a Genre Classifier for Automatic Classification of Web Pages. *CIT: journal of computing and information technology*, ISSN 1330-1136, 2007, vol. 15, no. 4, pp. 305-311.

[6] AI Watch Index, EU Report 2021, https://ai-watch.ec.europa.eu/publications/ai-watch-index-2021_en

[7] Wurman, P. R. et al. *Nature* **602**, 223–228 (2022).

[8] Gerdes J.C., Neural networks overtake humans in Gran Turismo racing game, February 2022, Nature News, https://www.nature.com/articles/d41586-022-00304-2

[9] Tomlein, M., Pecher, B., Simko, J., Srba, I., Moro, R., Stefancova, E., Kompan, M., Hrckova, A., Podrouzek, J., Bielikova, M., Black-box Audit of YouTube's Video Recommendation: Investigation of Misinformation Filter Bubble Dynamics, IJCAI Proceedings, 2022, https://www.ijcai.org/proceedings/2022/0749.pdf