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Why the EU lacks behind China in AI development

Analysis and solutions to enhance EU's AI strategy

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Abstract

With data availability exponentially increasing in the coming years, artificial intelligence (AI) will become a shaping factor in determining the competitiveness of economies going forward. With China's giant consumer market, more flexible and less strict regulations, and more venture capital investments, China has a better chance of coming out on top in this tech race. While AI development is not a zero-sum game, leading in AI is important for the EU if it wishes to continue shaping global norms and retain technological sovereignty. This policy brief contributes to this issue by outlining key trends and facts around AI and building on those, providing tailored solutions for the EU to adopt. The three most important steps the EU could take right now are, first, increasing capacity for training AI students by attracting more AI teachers. Second, increasing the flexibility for companies to use data in an anonymised way to train their AI, with special importance attached to the concept of informed, direct consent, which should be allowed to be deviated from if for certain R&D purposes. Third, the EU should stimulate businesses to move AI R&D partly to Eastern Europe. This will connect the lower wages and the need for economic development in the East of the EU with the need for AI talent and workers in the West of the EU. Combined, these policy recommendations deal with the shortage of AI experts, the legal barriers to AI development and the competitiveness of European industries. With AI, it is like the Chinese idiom 逆水行舟，不进则退, if we do not make progress fast enough, we are falling behind.

Introduction

Artificial intelligence (AI) is currently transforming the world as we know it. It is hard to overstate the effect of AI. The change it brings is taking place across so many industries, both civilian and military, both new and established, both domestic and international, that it impacts each major power's future prosperity significantly. This places AI in the middle of international politics. Given that AI has only been a key priority for major countries in the last several years, it is remarkable what has already been achieved. In transportation, AI enables self-driving cars (Forbes, 2018a) and in e-commerce, the use of AI is making a significant difference for online sales (Forbes, 2018b). Additionally, AI's use in cybersecurity is growing. Consequently, AI is crucial to Europe's industrial competitiveness and technological sovereignty. However, in terms of capabilities, the EU has been lagging behind both China and the US (ELLIS, 2018). To a certain extent, this is because China puts more importance on AI. A recent KPMG venture capital report rightfully argues that AI can and will be one of China's "primary growth differentiators'' (KPMG, 2019, pp. 6). China's State Council (2017, pp. 3) strategy report clearly recognizes the need for AI in China's future development, even goes as far as calling it "a core driving force for [the] next round of industrial transformation". The importance China attaches to AI alone is already a reason for the EU to become worried, because China's rise and soon also lead in AI will also challenge the EU's preferred role of norm shaper for the rest of the world. Indeed, to the EU, China is not only a cooperation partner, but also a systemic rival with which the EU faces an economic competition centred around technological leadership (European Commission, 2019a). Furthermore, in China, technological development is closely related to the military and military objectives. Therefore, it is beyond question that AI development in China will be used to support China's growing military ambitions. This puts AI in the middle of geopolitics. Moreover, China is using AI in controversial domestic surveillance systems, such those in Xinjiang (Human Rights Watch, 2018; Allen, 2019). Thus, the race for AI excellence is not only of economic concern, but also one of military and strategic importance. Therefore, if the EU does not close the gap in AI soon, the consequences will be far reaching.

To make the EU catch up, the European Commission (EC), from 2018 onwards, started working on a common AI approach for the whole EU to accelerate AI development (European Commission, 2018a). Such efforts are a few years later compared to China. The EC's strategy can be said to focus on creating a human centred AI, with a lot of regulations on the use of data (European Commission, 2018). The White Paper on AI earlier last year outlines the EC's strategy to promote AI development and usage, and to address associated risks of AI (European Commission, 2020a). In general, five elements can be said to make AI thrive. Those are abundant data, innovative entrepreneurs, high quality AI scientists, an AI friendly policy environment (see Lee, 2018), and also well targeted and abundant funding. Unfortunately,

the EU is underperforming in most of these factors compared to China. To address the issue of the EU's weak position in the global AI competition, this policy brief analyses the main global trends relevant for the EU and compares the EU to the corresponding characteristics of China's AI ecosystem. The analysis forms the basis for policy recommendations, which follows afterwards. This policy brief then closes with a call for action for the European Commission and relevant stakeholders, because change is needed. Now.

I.   Key trends

More data worldwide and the EU's increased data reliance

The AI landscape around the world is changing constantly. The amount of data in the world is growing exponentially fast. Data is one of the cornerstones on which AI relies, its lifeblood so to say. In 2018, there was an approximate 33 zettabytes of data in the world (European Commission, 2020a). A single zettabyte is 10^21 bytes. While already an unfathomable amount by itself, it is projected that by 2025 there will be between 175 zettabytes of information in the world (European Commission, 2020a; IDC, 2018). As a frame of reference, if you were to download that 175 zettabytes of data using an average US internet connection of 25Mb/s, it would take 1.8 billion years to complete the download (IDC, 2018). Thus, what this development shows, is that with such an increase in data, more and more possibilities open up for AI to be employed and improved. Data is the lifeblood to AI like oil is that to a car. Right now, there is only so much AI can do given the current amount of data. However, with more and more data, AI can be used in situations where now data is lacking and in others the AI will become more and more sophisticated. This requires a constant attention of the European Commission to direct the change of the European society in preferable directions.

Unsurprisingly, a 2017 study states that "it will soon become impossible for conventional engineering solutions to handle the increasing amounts of available data" (Gartner, 2017). Most of this growth in data comes from China, especially because of video surveillance (IDC, 2018). Europe is projected to have less growth in data because of the GDPR privacy regulation, but rapid growth nonetheless (IDC, 2018). The more data there is, the better AI can give recommendations and find correlations. This applies to areas such as advertisement, facial recognition, voice recognition and many others. Another big change within the next few years in data is that data processing will move from almost all done by centralised computing facilities to being handled majorly by smart connected objects from the internet of things (IOT) (European Commission, 2020b). On the other hand, a large share of public and industrial data is not being used for AI in the EU right now (European Commission, 2020a). Yet, the European Commission expects the value of the data economy to go from 2.4% of the GDP of the whole of the EU in 2018 to 5.8% in 2025 (European Commission, 2020b). Overall, this shows that data and with it AI become increasingly important in the EU's economy but at the same time the EU is not making full use of its potential yet. Moreover, the data available grows faster in China than in the EU, which complicates the EU's goal to be leading in AI development.

EU's increased focus on privacy regulation limits AI development

The EU is trying to create a human centred AI ecosystem, but these efforts are likely to hamper its growth. The main impediment to AI is the General Data Protection Regulation (GDPR). The GDPR sets forth various restrictions on the use of data, such as the explicit consent for each specific use. As a result, many data are not shared or used in the EU. One stakeholder describes the GDPR as having a "chilling effect on entrepreneurship, innovation, and creativity." (IoTTech, 2017). Many companies fear penalties which can be as high as twenty million euros or 4% of a company's global turnover (IoTTech, 2017). Therefore, even though the EC wants to create EU data pools (European Commission, 2020a), such efforts only work for private non-consumer data and public data (Future of Privacy Forum, 2018). This means that an important part of data is being neglected, namely consumer data. While the European Commission (2020a) is aware of the relatively limited use of consumer data for AI purposes in Europe, no concrete steps have been taken to resolve this issue. Thus, the GDPR continues to stifle AI companies into acquiring data, while elsewhere tech giants are raced because of the fewer restrictions they face.

China's regulatory framework: less strict, attractive for business

China's regulations on privacy are less strict, enabling the creation of bigger and qualitatively better datasets. China has regulations in place that are inspired by the EU's GDPR, but its formulation leaves more room for interpretation (CSIS, 2018). The Chinese version allows for implicit or implied consent, much like the US' (CSIS, 2018). Contrarily, GDPR of the EU requires explicit and informed consent. Given this discrepancy, researchers and start-ups have more freedom to experiment on data in China. Such freedoms are highly valued by entrepreneurs (Lee, 2018). On the other hand, China is amongst the countries that is continuously enhancing its privacy regulation and currently there is new legislation under consideration in China that is stricter than its predecessors and even includes privacy regulations specifically on the state. It is likely that these kinds of liberties will continue to exist in China. Therefore, even if new AI techniques are developed in the EU, China is prone to be businesses' favourite destination for the employment and commercialisation of these techniques. Because business R&D and academic research are mutually reinforcing, this grinds away at the EU's current strong research position.

EU low on AI excellence start ups compared to China

Start ups of today, are the giants of tomorrow, and those giants are likely not European. Out of all the artificial intelligence tech-unicorns, start-ups in tech with a value of over 1 billion

USD, only one is from the EU (CBS Insights. 2020). In comparison, China has more than ten times as many, namely 12. Thus, in excelling AI start-ups, the EU lacks behind. Looking at the quantity of start ups, however, a 2019 study shows that 25% of all the start-ups in the world are from the EU (McKinsey, 2019). These numbers still included the UK, who performs above average on AI compared to the rest of the EU and has since left the EU, dealing another blow to the EU's AI competence. Nonetheless, the share of AI start-ups is higher than the EU's GDP share in the world, which stands at about 16% corrected for purchasing power parity (Statista, 2020). This shows that relative to its size, the EU still has an above average number of AI. Thus, the EU has an above average share of AI start-ups in the world, but a below average of excelling AI start-ups, especially compared to China.

Funding for AI: EU catches up, but does not overtake China

In the EU, venture capital investments and corporate funding are significantly lower compared to China. A 2018 OECD study found that after 2016 private investment in AI companies in China picked up speed (OECD, 2018). Even though the same can be said to be true for the EU, until 2018, the gap between investments is widening, not closing (OECD, 2018). Understanding this issue, in 2018, the Commission vowed to increase its own AI investments by 70% annually up to € 1.5 billion a year and hoped for the private sector and Member States to bring it up to € 20 billion a year (European Commission, 2018b). This effort is continued under Von der Leyen's Commission, with the European Digital Innovation Hubs with investments roughly on the same level as announced in 2018 (European Commission, 2019b). However, what governments spend on AI is a fraction of the private sector's expenditure on AI R&D (Allen, 2019). Unfortunately, in terms of private sector investments, the EU still remains behind (McKinsey, 2019). Therefore, EU's government funding alone will not significantly change the AI tech race. Venture capital and regular investments from the private sector could be stimulated if a more AI friendly eco-environment were to be set up. Until that time, overall AI funding in the EU will not be enough to set it apart from the other major powers.

China's AI has rapid growth, but partial reliance on the West remains

As of 2018, China has been one of the world's leading AI countries. In terms of quantity, China ranks first in the number of AI publications, AI patents and AI venture capital investment and it ranks second in the number of AI companies and in the size of its talent pool (Allen, 2019). Moreover, the most cited AI papers are also from China, indicating a high level of quality AI research as well (Allen, 2019). In addition, China has certain advantages such as a huge, data generating, population, fierce domestic competition, and government subsidies (Lee, 2018).

These will continue to help China stay on top in AI research and commercial application. Yet, China's AI industry and research is very reliant on other countries. More than half of AI publications from China are in cooperation with international researchers, according to a Tsinghua University study, and China is reliant on semiconductors from the West too (Allen, 2019). Therefore, China's AI progress has not yet let to technological sovereignty for China.

Shortage of AI experts leads to increasing salaries worldwide

There is a shortage of AI experts, especially on the top level, and as a result, companies, and research institutes in every part of the world try to use salaries to attract scarce employees (New York Times, 2017). On average, AI engineers in the EU and China have similar wages, averaging about 50 thousand euros a year (Reuters, 2018; Glassdoor, 2020; Asia Times, 2019; Business Over Broadway, 2018). This is mainly due to the rapidly growing tech salaries in China (Reuters, 2018; Nikkei, 2019). Nonetheless, the EU is at a disadvantage. First, while the average salary might be the same, the EU lags behind on salaries for top level AI positions, with salaries in China to well over half a million a year (Kharkovyna, 2019). Second, given that average living costs in China are lower than in the EU (World Data, 2019), the wage AI engineers get in China becomes slightly more competitive. On the other hand, the differences between countries within the EU are large. While many countries' wages are near the average, the salary for a machine learning engineer in the Netherlands is on average 150 thousand annually. A problem China and the EU both face, however, is that in the US wages for AI experts are significantly higher (New York Times, 2018). In the US, salaries for these experts could go up to over a million dollar annually (New York Times, 2018). Several efforts are made in the EU to attract and keep talent, such as the European Laboratory for Learning and Intelligent Systems, or ELLIS, founded in 2018. ELLIS is creating research centres in selected European cities. It plans to supply these new institutes with "at least 1.7 million euros" in funding every year (Artificial Intelligence News, 2019). However, given that ELLIS intends to hire half a dozen researchers at these institutes and there are still other costs, these scientists would likely only have 150 thousand euros as annual salary on average. While indeed substantial, it will not be enough to attract the world's top talents. Likewise, China's salaries, although higher for the top experts compared to the EU, it is not able to compete with the US in this regard either and similarly faces a shortage of top talents (Allen, 2019). Consequently, AI experts are not likely to leave the EU for China for salary reasons, but the EU does face a potential brain drain of its top AI experts to the US given the lower salaries in the EU. Thus, given this fierce competition in offered wages, the shortage for AI experts in the EU is expected to remain.

II.   Recommendations

→ *Increase universities' capacity of AI students*

There is a shortage of AI experts worldwide and securing AI experts determines future success. Because of it, salaries for the top functions soar. Right now, the salaries in the US are able to attract the world's top experts, leaving a shortage in both the EU and China. While top experts are at the edge of new discoveries, various experts point out that top level discoveries often allow other research institutes to quickly reproduce similar results (Allen, 2019; Lee, 2018). Therefore, to optimize resources, more students should be trained. Right now, however, many universities have a system in place that limits the number of students they accept of AI bachelors (Studiekeuze 123, 2020). The reason behind such restrictions is that because of all the attention for AI, more and more students are looking to study in this field and there are not enough teachers and resources to accommodate these students (NOS, 2018). These inefficiencies should be cleared up as soon as possible. In fact, the European Commission would do well to reallocate resources to universities for the purpose of attracting more teaching staff and thereby enhancing AI student capacity. Given that a large part of students would remain working in Europe because of their roots and would not as easily go to China for a job, such measures would benefit the European AI ecosystem the most. Moreover, if enough experts can be attracted to teach, then a second step would be to attract more excellent international students via merit-based scholarships. Even when a large part of these students are likely to leave the EU afterwards, the investment will still pay off since talent is more scarce than financial resources and providing for students from when they were born until they reach the university level requires more resources than a scholarship, effectively making scholarships for foreign national an incredibly cheap way to train AI experts and even generate tax returns that way. Thus, training more students is arguably the most cost-effective way to close the AI gap between China and the EU.

→ *Increase flexibility of data usage*

Given that data is the lifeblood of AI, the EU should amend the GDPR to allow for the easier creation of anonymized consumer data pools. The key issue preventing such data pools is the GDPR's consent regulations. For example, both China and the US allow for implied consent for the use of consumer data, this allows for more data extraction. Moreover, it also allows for changing the purpose of data processing if the need for it arises, this increases the flexibility for companies to also use data for AI even if before it was not their intention in collecting the data. The EU is much stricter. Currently, entrepreneurs and businesses are too afraid to use data, given the high penalties that exist for violations. Therefore, because companies have to manage the risk of potentially making a misstep with the GDPR and having to pay for it, it is imaginable that businesses in the EU are not using their data to the fullest legally allowed

boundary. This is especially so given that the GDPR is a relatively new piece of legislation and that it takes some time for legal certainty to arise, given that usually these issues are settled in court and this process takes a few years. Still, additional clarification from national privacy agencies in the way they enforce the law may help to reduce some level of uncertainty and improve data utilization. On the EU level, the European Commission's proposed Digital Services Act, while imposing more restrictions on big platforms, would offer more clarity. Nonetheless, more efforts are needed to clearly communicate to companies the extent to which they can collect and bundle data, with special attention paid to the issue of consent.

→ *Capitalize on difference between the EU's East and West*

Within the EU, average salaries for AI experts vary tremendously, with up to five times higher wages in the Netherlands than in Eastern Europe. At the same time, companies in Western Europe struggle to find the right talent for the job because of shortages in AI students. Already, many American companies are recruiting and setting up research departments in the East of the EU (The New York Times, 2017). Similarly, the EU should capitalize on the differences in the EU as well by making investment in these areas more attractive for European companies and connecting the supply and demand of AI talent. To fulfil the need for more AI talent, the EU should stimulate companies in Western Europe to open up technical departments or research centres in Eastern Europe. This connects the investments companies in Western Europe could bring with the labour supply and comparative advantage from wages in Eastern Europe. Congruently, while underdeveloped in tech now, Eastern Europe could use this chance to leapfrog its technology gap, which would also help the region develop economically. The European Commission's Digital Innovation Hubs could be a good starting point, although it remains to be soon to what extent these hubs will be placed in Eastern Europe and how much they can induce companies to relocate their AI research branch to that region. Nonetheless, this initiative should be closely monitored, and bottom-up feedback should be collected to adjust the programme to the needs from businesses. Thus, by combining the strengths of different areas in Europe, the EU can create an environment that fosters faster AI growth.

Conclusion

The EU is falling behind on AI compared to China and smart, targeted investments in education are needed, alongside legal reforms that allow for more data gathering for the use in anonymized data analysis. Additionally, the need for AI talent in Western Europe should be connected with the desire for development in Eastern Europe by stimulating companies to open up R&D centres or branches there. On a more general level, the EU describes many goals in its most recent AI White Paper, but commitment to those goals need to be more concrete and targeted to where the problems are. Given salary disparities with the US, the EU nor China is likely to win the battle for the absolute top-level AI experts. To stay competitive, the EU not only needs to implement smart policies, but also timely policies, as a lag behind real world developments and political decision making could be enough to lose an edge in this rapidly developing technology. For the EU to retain technological sovereignty substantial action needs to be taken now. AI is transforming the world at an incredible pace and without shifting gears, the EU is bound to lose the race.

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