Plain Statistical Terms to Avoid Prejudicial Rejection of Machine Learning in Territorial Data Analysis

Ermanno Zuccarini[1]

[1]*Department of Engineering "Enzo Ferrari" (DIEF), Modena and Reggio Emilia University (UniMoRe), via P. Vivarelli 10, 41125 Modena, Italy*

Abstract

This position paper advocates the use of a statistical language to popularize the analysis of territorial data conducted with machine learning (ML) in smart city projects. The jargon of ML and AI - two terms often confused in popular culture - includes psychological terms that can easily dazzle and mislead laypeople. This can lead to alarmist and rejective reactions. Recent studies have analyzed people's perceptions of risk, their tendencies to anthropomorphize, and the presence of apocalyptic narratives about AI. Therefore, in this paper, a return to school logical concepts is recommended, delving into mathematics and specifically statistics when necessary, to soberly popularize AI branches. This approach would keep AI itself as a philosophical question. Moreover, the narrative of an "AI revolution" should not be emphasized in territorial projects, which should be inclusive. Better is an evolution perspective. To illustrate this point, an example of a public workshop is sketched in which people with different generational, social, and work backgrounds focus on the ML risks related to the study of territorial data in a smart city. Far from sensationalist conditioning, participants glimpse and discuss the not entirely new nature of these risks, paving the way to progressive learning.

Keywords

AI popularization, AI rejection, Smart cities, Statistics, Machine learning

1. Introduction

A return to the statistical foundations of machine learning (ML), when applied to territorial analysis projects, should be the criterion for clear, self-explanatory public communication. The psychologized terminology used among AI experts could in fact backfire, leading to rejection by the public, opposing political parties, and even members of the working group. The author of this article perceives this problem as urgent, while currently working with long short-term memory neural networks on urban heat island data analysis for the town of Carpi. This is the first module of the Carpi Smart City project[1]. The urban agglomeration is located in Italy in the central Po plain. Urban and climate data analysis excludes the investigation of individuals and the automation of decisions. However, any reference to AI could be interpreted as a sign of more intrusive or uncontrollable initiatives. A challenging context is provided by the recent and ongoing media coverage of AI. This coverage tends to popularize tools like GPTs and more generally ML, with an anthropomorphic perception, identifying all these technologies with "the

AIxIA 2024 Discussion Papers - 23rd International Conference of the Italian Association for Artificial Intelligence, Bolzano, Italy, November 25–28, 2024

ermanno.zuccarini@unimore.it (E. Zuccarini)

https://it.linkedin.com/in/ermannozuccarini (E. Zuccarini)

0000-0003-1611-2448 (E. Zuccarini)

AI." The subdivision of AI in its branches is ignored. This whole narrative fosters in the public a generic fear of uncontrollability and takeover by self-evolving intelligent software, implicitly evoking scenarios that are contrary to transparency and democratic participation. For these reasons, there is a need for public communication that references commonly understood school concepts and does not confuse laypeople with AI jargon. The specialist terminology of ML should not be discarded, but rather gradually introduced after straightforward mathematical notions.

2. People's AI: perceived risks, anthropomorphism and apocalypse

Recent social research contributes to better shape widespread opinions and sentiments about AI. Haesevoets et al. [2024] [2] in studies conducted in the UK on public sector decision-making found that people prefer AI to have some, but significantly less, weight than politicians, citizens, and human experts. This particularly regards decision roles and ideologically charged decisions. Bao et al. [2022] [3] studied the segmentation of the US population about the risks and benefits of AI in general. The negative class (33.3%) was prevalent. Kieslich et al. [2022] [4] analyzed the different weights given to main ethical aspects of AI: explainability, fairness, security, accountability, accuracy, privacy, and machine autonomy. Emerged five groups: ethically concerned (31.4%), indifferent (24.3%), safety concerned (15.2%), fairness concerned (15.1%), endorsing human control (14.0%). Dydrov et al. [2023] [5] conducted a key terms survey with Google Trends and Yandex. The range of markers applied to AI by people comprises: "dehumanizing", "godless", "soulless", "dangerous", "dead", "rational", "will help", "create", "destroy", "enslave", "kill". This anthropomorphization shows metaphysics in people's discourses, where the person perceives himself not equal, but inferior to the algorithm. For Mascareño [2024] [6] climate change and artificial intelligence have inspired numerous apocalyptic visions of the future. Both scenarios predict a world-ending outcome unless immediate action is taken. For the general public, apocalyptic eschatology offers an attractive alternative, blending oversimplified explanations, calls to action, justification for resource allocation, and even specific outcomes.

3. Position expressed

3.1. The need to understand in a familiar way

What is a smart city project? It could be defined as "a place where traditional networks and services are made more efficient with the use of digital solutions for the benefit of its inhabitants and business"[7]. Regarding ML, it is easy to highlight its statistical nature in projects like that of Carpi, where typical classification or regression operations are performed on territorial data using neural networks for predictive purposes. Communication and education initiatives need to promote this understanding by properly referencing examples from the scientific literature[8]. Basic concepts of symbolic logic and mathematics can enable high school students to practice small implementations of expert systems and neural networks. But this approach cannot be expected from a population that has not recently engaged in school studies. However, presenting

the mathematical concepts of ML in popularization and basic courses, with simple application examples, even graphically animated, is the right way to dispel the myth of a super-intelligence and provide a realistic understanding of the subject. An objection to this approach could be raised: the risk of debasing the identity language of the AI community. But the common use of that jargon is only subordinate to clarifying introductions.

3.2. Feet on the logic-mathematical grounds and AI as a philosophic question

What if, in popularization, AI becomes ”real” through concrete software applications, or worse, the term *AI* is used as a kind of commercial label? If AI does not remain a philosophical question on the horizon, then the applications that are affected can turn delusional when their logical-mathematical structure is gradually understood. Clarifications about ’narrow’ AI may sound like an adjustment. However, if a bold popularization effort is made to present these applications as a continuation of their classic logical backgrounds, their advancements compared to previous technologies could be better perceived and appreciated as genuine progress. The commonly used jargon of AI remains, but when intended just as a jargon, it stops to be a source of understanding problems. Furthermore, a significant portion of the population has a cultural education that tends to go beyond mere pragmatism. This leads to dissatisfaction with the perceived equivalence between human and artificial intelligence based on external appearances, such as the Turing test. The focus shifts instead to the different generating processes rooted in either biological or electronic nature. The reflection then continues philosophically: does the human mind, which invents AI, transcend it? If so, in what way?

3.3. The narrative of evolution is more inclusive than that of revolution

The rhetoric of revolution characterizes the narrative of modern and contemporary changes in many areas: politics, science, industrialization, social habits, and, of course, technology. It sharply separates a before and after, imposing a new language to describe the innovative scenario. People are divided between those who embrace the revolution, along with the relative effort in personal change, and those who remain behind. Similarly, AI language marks a clear break from the past. However, its rhetoric can be a discouraging factor for people who need to understand its basic paradigms starting from their educational and common sense background. Hence, the importance of a historical evolutionary perspective that starts from traditional disciplines. In conclusion, the feeling of displacement caused by the acceleration of progress must be avoided in public communication and education if a public project aims to be truly inclusive toward the population. Moreover, there is a subtle apocalyptic pattern in thinking about the *accelerating future* that must be critically analyzed in educational work.

3.4. An idea of public collaborative workshop: giving an interdisciplinary and historical depth to AI risks in Smart Cities

Shifting from the above general views, here a collaborative public workshop is outlined. It could be part of educational activities related to territorial data analysis with ML in a smart city project. This workshop is based on the research ”Artificial Intelligence and Urban Development”[9], which was commissioned by the European Parliament’s Committee on Regional Development

and published in 2021. The research provides a nonexhaustive list of risks associated with the deployment of AI in smart cities. Although some of these risks are more relevant to ML in data analysis, cross-referencing with the remaining risks may prove fruitful.

1. Performance risk: errors, bias, opacity (i.e., ”black-box”), poor explainability, performance instability;
2. Security risk: cyber-intrusion, open-source software, privacy;
3. Control risk: AI going ”rogue”, inability to control malevolent AI;
4. Ethical risk: ”lack-of-values”, value-alignment, goal-alignment;
5. Economic risk: job-displacement, ”winner-takes-all”, liability, reputational risk;
6. Societal risk: autonomous weapons proliferation, ”intelligence divide”.

The EU document does not differentiate between the various branches of AI or between AI and traditional computer science, and many of the listed risks are not unique to computer science, although its power amplifies them. A popularizer might easily present these as *completely new* threats of AI, either due to a limited perspective or sensationalist purposes. The main objectives of the workshop are:

1. Historical continuity vs. novel risks: identify which elements of the listed risks have historical precedents and which are entirely new.
2. Interdisciplinary analysis: use the diverse generational, social, and professional backgrounds of the participants to enrich the discussion and multiply perspectives.
3. Expert guidance: employ a blended top-down and bottom-up approach, guided by experts, to facilitate a comprehensive analysis.

Take, for instance, a possible development of point 1 related to performance risk: errors, bias, opacity (i.e., ”black-box”), poor explainability, and performance instability. The top-down part begins with an experienced statistician providing traditional examples of tools and associated risks. The discussion then transitions to ML, with references to statistical learning. Finally, new risks are identified and illustrated with examples. In the bottom-up phase, each participant shares how the presented concepts could relate to their own experiences.

4. Conclusion

AI is often anthropomorphized and mythologized by the general public. Therefore, supplementary work in communication and education is required, incorporating notions from commonly known mathematics with in-depth excursions into statistics. This approach could diminish the dazzling effect of AI’s psychologized jargon and allow people to better focus on the not entirely new risks of ML with a renewed historical perspective. In the later phases of the Carpi Smart City project, the above will be tested.

References

[1] Smart City. Carpi città pilota. Ma il 5g non c’entra, 2020. URL: https://ruggeropo.it/smart-city-carpi-citta-pilota-ma-il-5g-non-centra/.

[2] T. Haesevoets, B. Verschuere, R. V. Severen, A. Roets, How do citizens perceive the use of artificial intelligence in public sector decisions?, Government Information Quarterly 41 (2004). doi:10.1016/j.giq.2023.101906.

[3] L. Bao, N. M. Krause, M. N. Klause, D. A. Sheufele, C. D. Wirz, D. Brossard, T. P. Neumann, M. A. Xenos, Whose ai? how different publics think about ai and its social impacts, Computers in Human Behavior 130 (2022). doi:10.1016/j.chb.2022.107182.

[4] K. Kieslich, B. Keller, C. Starke, Artificial intelligence ethics by design. evaluating public perception on the importance of ethical design principles of artificial intelligence, Big Data and Society 9 (2022). doi:10.1177/20539517221092956.

[5] A. A. Dydrov, S. V. Tikhonova, I. V. Baturina, Artificial intelligence: Metaphysics of philistine discourses, Galactica Media: Journal of Media Studies 5 (2023) 162–178. doi:10.46539/gmd.v5i1.302.

[6] A. Mascareño, Contemporary visions of the next apocalypse: Climate change and artificial intelligence, European Journal of Social Theory 27 (2024) 352–371. doi:10.1177/13684310241234448.

[7] Smart City, (n.d.). URL: https://commission.europa.eu/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en.

[8] B. Warner, M. Misra, Understanding neural networks as statistical tools, The American Statistician (1970). doi:10.1080/00031305.1996.10473554.

[9] E. P. D. for Structural, C. P. D.-G. for Internal Policies, Artificial intelligence and urban development, 2021. URL: https://www.europarl.europa.eu/RegData/etudes/STUD/2021/690882/IPOL_STU(2021)690882_EN.pdf.