Foreword

Development in the field of artificial intelligence (AI) is making giant strides. Allow me to outline some of the areas addressed by the AI sector last year.

Supervised learning methods continued to dominate industrial AI applications, but they require large amounts of (labelled) data, which is time-consuming and costly. Self-supervised learning is about assigning data labelling to an AI. Here, experts label only a small amount of data manually, which is then used by an AI for the automated labelling of the remaining data. Self-supervised learning continues to face a number of technical challenges, including the fact that machine-labelled data must be of high quality if it is to produce results that are almost as good as those arising from manually labelled data.

In the area of privacy-preserving machine learning, many organisations could potentially benefit from sharing data with other, similar organisations to train good models. Health insurers could, for instance, work together on solving the automated processing of unstructured paperwork such as insurers' claim receipts. The issue here is that organisations cannot share their data with each other for confidentiality and privacy reasons, which is why secure collaborative machine learning – where a common model is trained on distributed data to prevent information from the participants from being reconstructed – is gaining traction. This shows that the biggest problem in the area of privacy-preserving machine learning is not technical implementation, but how much the entities involved (decision makers, legal departments, etc.) trust the technologies. As a result, the degree to which AI can be explained, and the amount of trust people have in it, will be an issue requiring attention in the years to come.

The representation of language has undergone enormous development of late: new models and variants, which can be used for a range of natural language processing (NLP) tasks, seem to pop up almost monthly. Such tasks include machine translation, extracting information from documents, text summarisation and generation, document classification, bots, and so forth. The new generation of language models, for instance, is advanced enough to be used to generate completely realistic texts.

These examples reveal the rapid development currently taking place in the AI landscape, so much so that the coming year may well witness major advances or even a breakthrough in the following areas:

- Healthcare sector (reinforced by the COVID-19 pandemic): AI facilitates the analysis of huge amounts of personal information, diagnoses, treatments and medical data, as well as the identification of patterns and the early identification and/or cure of disorders.

- Privacy concerns: how civil society should respond to the fast increasing use of AI remains a major challenge in terms of safeguarding privacy. The sector will need to explain AI to civil society in ways that can be understood, so that people can have confidence in these technologies.

- AI in retail: increasing reliance on online shopping (especially in the current situation) will change the way traditional (food) shops function. We are already seeing signs of new approaches with self-scanning checkouts, but this is only the beginning. Going forward, food retailers will (have to) increasingly rely on a combination of staff and automated technologies to ensure cost-effective, frictionless shopping.

- Process automation: an ever greater proportion of production is being automated or performed by robotic methods.

- Bots: progress in the field of language (especially in natural language processing, outlined above) is expected to lead to major advances in the take-up of bots, such as in customer service, marketing, help desk services, healthcare/diagnosis, consultancy and many other areas.

The rapid pace of development means it is almost impossible to predict either the challenges we will face in the future or the solutions destined to simplify our lives. One thing we can say is that there is enormous potential here. The universities in the TriRhenaTech Alliance are actively contributing interdisciplinary solutions to the development of AI and its associated technical, societal and psychological research questions.

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