Q&A with a preeminent deep learning researcher

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One of deep learning's "founding fathers" describes what's next machine learning technique and how it will revolutionize health

University of Montreal professor Yoshua Bengio is well known for his groundbrea intelligence, most specifically for his discoveries in deep learning. Bengio has sh than 200 published journals and reports and most recently began imparting his entrepreneurs in the start-up factory he co-founded, Element AI.

What areas of deep learning research do you find most exciting and promisi

One is deep unsupervised learning, which is using deep learning principles to le
meaning without human guidance or labels on the data that is fed into AI systen

Our main industrial systems derived from deep learning—such as speech recogr
image search, self-driving cars, vision systems for blind people, etc.—take advar
supervised learning, yet humans are very good at *unsupervised* learning, and we
progress in that direction to approach human-level AI.

And then understanding and generating natural language are also exciting areas
have a huge impact on applications such as dialogue, understanding documents
etc.

However, many hard problems remain open, like how to allow AI systems to aut
semantics—in other words, how to represent more abstract concepts and the m
more complex thoughts, such as those we express in a phrase, a sentence or a p

**Which of these will likely be ready for widespread use in real-world applicat
years?**

We'll probably see systems that can understand and do a good job at generating
within the next five years, while deep unsupervised learning is likely to be farthe
years of patient, fundamental research.

What level of reasoning is AI able to achieve today?

Reasoning is about combining elements of knowledge, so in order to do a good j
that knowledge in the first place. Traditional reasoning methods are very powerf
knowledge on which to reason. That is why reasoning has to be coupled with ma
extracts the knowledge from data. Current systems that learn to reason are still
fact that we are able to learn to reason using attention and memory extensions
promising.

**What will unlock the ability for computers to reason at the level of a human
think this is?**

Difficult to say. Clearly one obstacle is simply to scale the current approaches. A
question of knowledge representation. Knowledge graphs were designed to be
may need to learn other forms of representation which are more amenable to be
automatically—from documents, for example— by deep neural nets.

You've said that health applications are an important area of deep learning a so?

Absolutely. It could have a huge impact on everyone's health, for example on tac main killer in our societies. AI will allow for much more personalized medicine a use of large medical datasets. We'll see patient-specific treatments—for exampl genomic and expression data, which are much more likely to work. Currently we instruments to treat patients. This has the potential to change a lot. And we'll als use of doctors' time.

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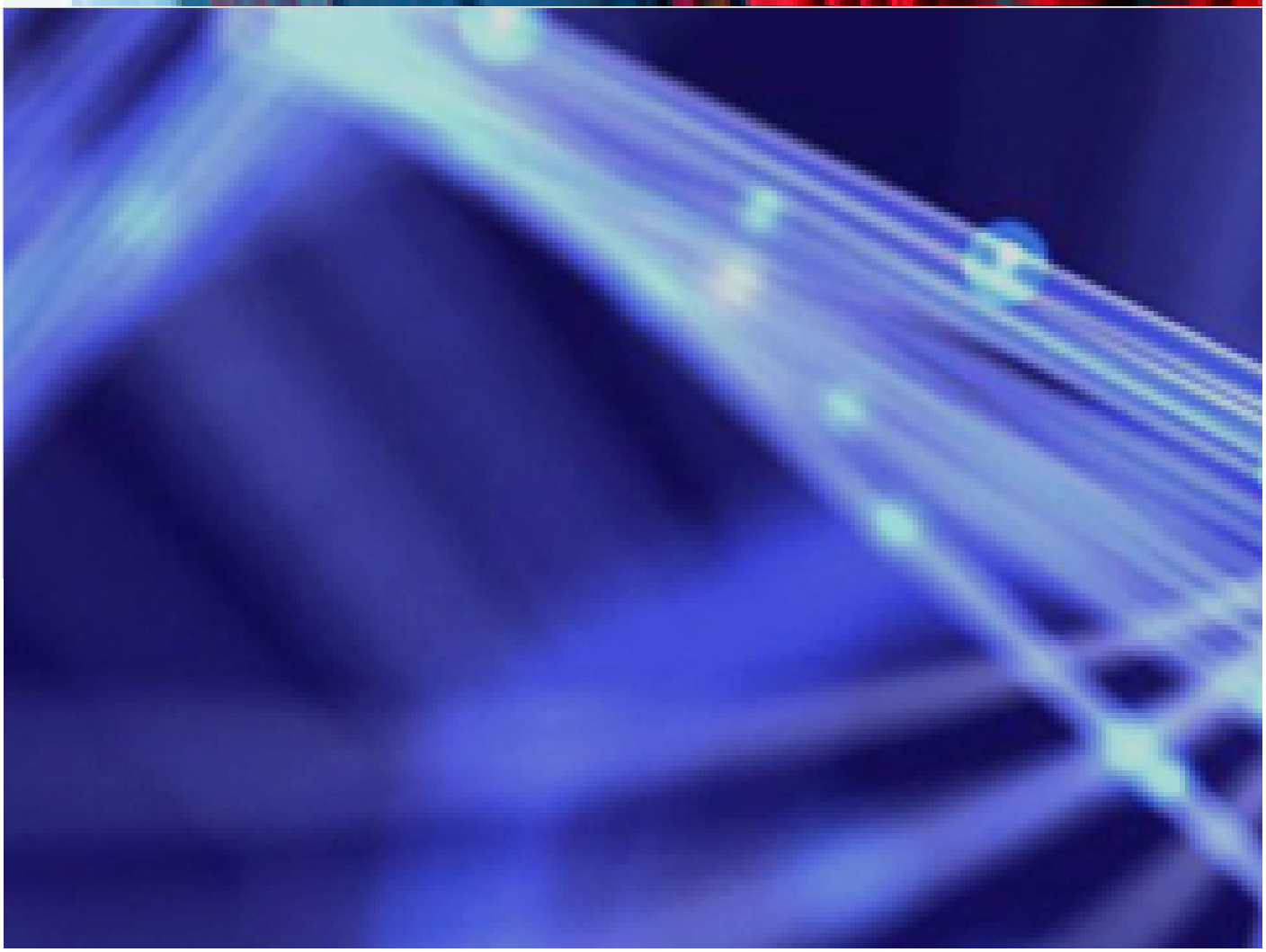

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