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Education in the Era of Google, Wikipedia, and Deep Learning: Are We Humans Still Needed and If Yes for What?

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Education in the Era of Google, Wikipedia, and Deep Learning: Are We Humans Still Needed and If Yes for What?

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Abstract One of the main purposes of education is to teach skills needed in future life and future jobs. What is important and what is useful changes with time. Before the industrial revolution, routine mechanical work was an important part of human activity – now machines can do it (and do it better). Before printing, copying was an important activity – now copy machines do it. Before computers, humans were needed for computing – now computer do it better. With Wikipedia and Google, there is not much need for scholars being erudite. Even extracting dependencies from data – one of the most creative human activities – is now often done automatically, by deep learning techniques, and these techniques are getting better every day. Students that we teach now will be in the workforce for many decades. What should we teach them that will remain useful to them in decades to come? Our answer: ability generalize from a few facts, this is where we are still better than computers.

Keywords: future of education, human vs. machine creativity, bounded rationality, experimental psychology, why-questions.

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Research problem.

One of the main purposes of education is to teach skills needed in future life and future jobs. The problem is that what is important and what is useful changes with time.

- Before the industrial revolution, routine mechanical work was an important part of human activity – now machines can do it (and do it better).
- Before printing, copying was an important activity – now copy machines do it.
- Before computers, humans were needed for computing – now computer do it better.
- With Wikipedia and Google, there is not much need for scholars being erudite.
- Even extracting dependencies from data – one of the most creative human activities – is now often done automatically, by deep learning techniques, and these techniques are getting better every day.

Students that we teach now will be in the workforce for many decades.

What should we teach them that will remain useful to them in decades to come?

Purpose of the study

The main purpose of this study is to provide general guidelines for predicting what human skills will remain important in the future – and thus, what skills we need to teach to students to better prepare them for this future.

Research method

To better understand where creative human reasoning can be useful, we need to better understand this reasoning.

In our study, we actively use the results of experimental psychology, especially research by Nobelist David Kaheman and others on limitations of human reasoning; see, e.g., (Kahneman, 2011). According to this research, one of the main reasons why our decisions are suboptimal (and often even irrational) is that we

have what psychologists call *bounded rationality*, a very limited ability to actively memorize and process information.

At first glance, this sounds like a handicap.

However, on second thought, maybe not:

- with huge number of neurons in the brain,
- why would billion years of evolution select such limited data processing abilities?

The fact that evolution selected this makes us believe that this bounded rationality is actually an advantage.

Indeed, to survive, we need to predict the future situations, and it is advantageous to predict based on as little information as possible. This ability to extract rules from few examples is the humans' main asset:

- deep learning needs thousands of examples for this where
- we humans need only a few.

This is what we need to concentrate on: *ability to provide a common explanation for several phenomena.*

Recommendations

Students should not just memorize formulas and algorithms – they should learn how different formulas and algorithms can be derived from basic principles.

In teaching, the emphasis should be:

- not on "What?" and
- not on "How?"
- but on "Why?".

For example, if a student understands why, he/she can derive the formulas – this is, e.g., how mathematicians learn formulas (as opposed to, e.g., engineers).

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