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

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1. 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 computers do it better.
- With Wikipedia and Google, there is not much need for scholars being erudite.
2. Research Problem

- Even extracting dependencies from data:
  - one of the most creative human activities,
  - is now often done automatically, by deep learning techniques.
- 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?
3. 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.
4. 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.
- Specifically, we use research by Nobelist David Kahneman and others on limitations of human reasoning.
- 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.
5. Research Method (cont-d)

- However, on second thought, maybe it is not a handicap:
  - 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.
- 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.
6. 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).
7. References

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