

Synthetic Data and Generative AI Methods: From Numbers Back to Words

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1. Leibniz's dream: we are not yet living in it

- Leibniz famously predicted that in the future:
 - all decisions will be made by calculations, and
 - all arguments will be decided by calculations.
- We have not fully reached this stage yet.
- When we ourselves make decisions, we still use words, because we are more comfortable with them than with numbers.
- For example, we select a restaurant because it is faster – or tastier – or cheaper – or has better service.
- When we praise a student, we rarely cite numbers, we say good academic record, hard working, smart, etc.
- A good medical doctor does not use an algorithm to prescribe a medicine.
- She uses words and arguments to convince us that her decision should be followed.

2. But to a large extent, we are already living in Leibniz's dream – and the situation seems to be getting worse

- However, when a country or a company makes a serious decision, indeed calculations are involved.
- Good news is that we can still understand them if needed.
- We can learn decision theory, we can learn quantum physics – if a decision involves quantum effects.
- And by “learn”, we need explaining them in words.
- But even this may soon come to an end.
- Deep learning models make decisions that we cannot understand at all, and explainable AI (XAI) remains largely a pipe dream.
- Are we doomed to make common sense and words completely obsolete?

3. There is hope

- We believe that there is hope: that generative AI can help go back to understandable words.
- The problem with words is they are somewhat ambiguous.
- The meaning of “faster restaurant” or “high blood pressure” is not precise.
- We can ask individual experts about their understanding, but the result will still be subjective.
- And here generative AI can help.
- We can ask it to generate simulated patients with high blood pressure.
- We can ask it to generate CS problems that are slightly more complex than average.
- Current AI is based on all the information we have in the world.
- So, the resulting models will be less subjective.

4. There is hope (cont-d)

- We can train folks on these examples.
- Not only we will teach medical students how to cure these patients.
- We will also make sure that different folks have similar understanding of what high blood pressure means.
- In general, this will make communications between people easier and more productive.
- AI can help transform imprecise word-based expert rules into precise recommendations of what to do in each situation.
- And by trying different treatments on simulated patients, we may come up with new rules – and thus reach XAI.

5. Zadeh's dream instead of Leibniz's dream

- Transforming natural-language rules into precise actions is what Lotfi Zadeh started with his fuzzy ideas.
- The problem with naive use of his method is that it relies on assigning numbers to beliefs, which is very subjective.
- Zadeh's dream was always to avoid explicitly using numbers, to do “computing with words”.
- It looks like generative AI can help us follow this dream.
- This will be more convenient for us than Leibniz's dream in which we are living right now.
- So let us all work together to make this dream true!