I have worked in Natural Language Processing since 1985, when I started MSc at Técnico, Lisbon, and was a student of João Pavão Martins, of the first generation of AI in Portugal.

In 1999 I organized a national session on the Computational Processing of Portuguese for the White Book on R&D in Portugal, and from 1999 to 2010 I was fully dedicated to Linguateca, a resource and evaluation network for Portuguese.

For the last 10 years I have been working at the Faculty of Arts of the University of Oslo, and therefore I will try to bring you a somewhat wider perspective, from philosophy, statistics, medical studies and sociology.

My intention in this talk is to call the attention to the issue of values in human language, and to discuss a concrete case (word embeddings) voicing some objections.
A reflection on terminology

Natural and artificial intelligence, language...

- In SLATE, there are human languages and computer languages, or better even human-human, human-computer, and computer-computer languages. Interestingly, the only call which mentioned intelligence was CCL (“computer intelligence”).

- However, the term natural language is by far the most common when dealing with language, while the most common term of all is obviously artificial intelligence

- Curiously, the terms artificial intelligence and natural language (processing, understanding, etc.) are often considered in a hyponymic pair (being NLP a part of or the hallmark of AI), while artificial languages are often just called languages (in the proper context), and natural intelligence is only used as a pun. The common concept is human intelligence.

Language is complicated, and evolves. So terms have the irritating property of having a history. They are not defined once and for all.

What is intelligence?

This is a question for philosophers. I am interested here in how we use the word intelligence, and applied to whom. Of course, it depends on the language.

- in English, there is intelligent and clever and smart, cunny, ...
- in Portuguese, there is inteligente and esperto and sagaz, perspicaz, astuto,…

Examples of uses of intelligent, not always obvious:

- Another classic example of such parallel communications is the device that we will use as the example in this section, the intelligent liquid crystal display (LCD) module. (Introduction to Mechatronic Design)
- newspaper parlance: sistema de semáforos inteligentes...
- smart phones, smart queries, … casas inteligentes
Human vs. machine intelligence

English leads us to initially interpret the pair as
  - intelligence displayed/owned by humans
  - intelligence displayed/owned by computers/machines

But is it the same intelligence? Or are we talking about radically different properties? (as in human/tropical nature)

Some examples

Signs of intelligence? It may depend on who/what does it.
  - RoboCup - soccer playing
  - Chess or Go playing
  - Encyclopaedic answer
  - Poetry writing
  - Lying to protect other’s feelings
  - Visually identifying a cancerous cell
  - Recognizing people in the street
  - Identifying a dialect
New paradigm: hybrid intelligence

van Harmelen, Frank. "Hybrid Intelligence: AI systems that collaborate with people, instead of replacing them". Keynote at IC3K 2020.

- augmenting human intellect and capabilities instead of replacing them
- achieving goals that were unreachable by either humans or machines alone
- AI is unaware of norms and values; reasons; contexts
- Necessary to have explanations, so that decisions can be disputed. Explanations need to be grounded on values, norms, motives, commitments, goals

Criteria for intelligence

- Learning
- Knowledgeability
- Alternative worlds
- Context awareness

Mimicking a human is different from being a human.
We only talk of **natural language** when we process it with computers, therefore doing AI.

Humans devise languages (programming languages) for computers (this is called language engineering), with properties very different than those they use in human languages.

Revisiting my own talk in PROPOR 2006, what characterizes a natural language is

1. Metaphorical nature
2. Context dependency
3. Reference to implicit knowledge
4. Vagueness
5. Dynamic character (evolution and learnability)

I would like to add: 6. it embodies **values**.

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**What is human language for?**

Heavily inspired by Ellis (1993) and Steiner (1975)

- for humans to understand the world: and thus categorisation
- for humans to do things
- for humans to create a shared community – and to put others outside

(Human) language is power. Human language is human centered.

_There are no diseases in nature. Only the states which have an undesired effect for the goals Man pursues receive this description. (Sedgwick, 1973)_
What is language for?

- Knowledge representation
- Communication:
  - to do things with others: collaboration
  - to inform or to disinform others

Values in programming languages?

Kent Pitman: What Programming Language Design Taught Me About Life, abstract of keynote at SLATE’18

I came to see languages as much more complex entities than mere functional behavior or stylized syntax. Languages are about community and shared values – and not just the kinds of values that get returned from a function call. The choices a language designer makes will attract certain users and alienate others
Computers understanding human language? understanding humans?

Jang Graat: How Humans Succeed While Failing to Communicate, abstract of keynote at SLATE’20

*The task of making a computer understand human communication therefore seems to be the hardest thing to do.*

Maybe we should communicate differently/other things with computers?

Valuation and evaluation

- To give value is something absolutely human: good and bad do not exist in nature or reality.
- In order to evaluate, you have to compare with something else. Usually, human judgement.
- However, not all judgements are consensual. Ethical paradoxes, different legal opinions, etc.
- Delfim Santos: culture is a ranking of values.

Human language always includes values, human values.
Let us now consider a specific technology which has come to dominate NLP in the last years: word embeddings, a form of representing context based on co-occurrence. Based on machine learning over big text collections (the crowd) – see Santos (2021) for looking critically at size.

- Several criticisms have been voiced: unpredictable, unstable, crowd-dependent, human-ununderstandable, climate-unfriendly, corporation-owned (Mihalcea, 2021)
- Use of word embeddings is like *atirar o barro à parede*
- Not taking different languages seriously

How do you evaluate static word embeddings?

- **intrinsic**: analogies, distance, clustering
- **extrinsic**: performance in real tasks, like NER, QA, classification, generation

Underlying assumption

- One learns a lot from large collections of text
- Quantity leads to quality
- From the statistical observation by Galton that the median estimate of a group can be more accurate than estimates of experts, the so-called “wisdom of the crowd”.

But not all crowds!

- What is the meaning of Norwegian *bjørnetjeneste*?
- What is the name of the eldest daughter of Lúcio Lara?

What matters is not how many answer, but the knowledge of who answers. Lorenz et al. (2011) show that social pressure undermines the effect of the wisdom of the crowd.
The study by Lorenz et al. 2011

Although groups are initially “wise,” knowledge about estimates of others narrows the diversity of opinions to such an extent that it undermines the wisdom of crowd effect in three different ways.

- The “social influence effect” diminishes the diversity of the crowd without improvements of its collective error.
- The “range reduction effect” moves the position of the truth to peripheral regions of the range of estimates so that the crowd becomes less reliable in providing expertise for external observers.
- The “confidence effect” boosts individuals’ confidence after convergence of their estimates despite lack of improved accuracy.

Static word embeddings on inteligência

300 dimensions, obtained on 1.5 billion words, Linguateca corpora:

- word2vec, words: intuição (0.68), imaginação, sabedoria, criatividade, sagacidade, habilidade, perspicácia, astúcia, intelecto, destreza (0.57)
- glove, lemmas: senso (0.85), habilidade, mente, criatividade, experiência, talento, certo, capaz, imaginação, excelência (0.76)
- fasttext, lemmas and mwes: ininteligência (0.95), contra-inteligência, desinteligência, Inteligência, inteligência-do-cinema, inteligibilidade, inteligXancia, diligência, inteligencia, inteligência (0.85)

300 columns, obtained on 2 billion words, common crawl:

- fasttext, words: inteligencia (0.77), Inteligência, ainteligência, perspicácia, inteligência.A, deinteligência, intelecto, contra-inteligência, intelegência, super-inteligência (0.62)
Static word embeddings on inteligência– contd

300 columns, obtained on ca. 1 billion words, NILC:
- word2vec: inteligência (0.68), inteligências, astúcia, imint, criptológica, engenhosidade, laboriosidade, sagacidade, intuição, imaginação (0.54)
- glove: habilidade (0.54), intuição, criatividade, força, sabedoria, senso, sensibilidade, imaginação, capacidade, talento (0.44)
- fasttext: inteligênciaX (0.96), geointeligência, super-inteligência, contra-inteligência, desinteligência, ciberinteligência, foto-inteligência, contrainteligência, superinteligência, deligência (0.88)

300 columns, obtained on ca. 1 billion words, NLX:
- word2vec: criatividade (0.71), intuição, imaginação, sagacidade, perspicácia, argúcia, sensibilidade, destreza, lucidez, inventividade (0.66)

Using a literary corpus with only 50 million words, dealing with words:
- word2vec: ciência (0.57), compreensão, capacidade, penetração, perspicácia, espírito, instrução, intelectual, sensibilidade, concepção (0.47)
- glove: ciência (0.59), sensibilidade, compreensão, espírito, energia, humana, imaginação, capacidade, superior, experiência (0.48)
- fasttext: ininteligência (0.97), desinteligência, Inteligência, inteligência, deligência, inteligências, vigência, desinteligências, consCiência, consciência (0.83)

Using the same corpus but just lemmas
- word2vec: espírito (0.62), intelectual, talento, inteligente, 'pírito, ciência, capacidade, compreensão, aptidão, faculdade (0.50)
- glove: espírito (0.60), talento, 'pírito, entendimento, capacidade, conhecimento, ciência, compreensão, práctico, bastante (0.46)
- fasttext: ininteligência (0.96), desinteligência, inteligência, deligência, intelecto, intelectualidade, inteligente, intelectivo, vigência, intransigência (0.78)
What is the crowd?

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<th>without numbers</th>
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<td>lemas</td>
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<td>304,249</td>
<td>65,900</td>
<td>390,415</td>
<td>281,097</td>
</tr>
</tbody>
</table>

Who should answer?

- Should one use the crowd, that is, a lot of different people who wrote different texts in different contexts and take the average?

- Or: Texts about a particular subject should be used when one is interested in that particular subject?

Unsupervised word embeddings capture latent knowledge from materials science literature

models trained on the set of all Wikipedia articles (about ten times more text than our corpus) perform substantially worse on materials science analogies. Contrary to what might seem like the conventional machine learning mantra, throwing more data at the problem is not always the solution. Instead, the quality and domain-specificity of the corpus determine the utility of the embeddings for domain-specific tasks.
The question of different languages

Materials for evaluating word embeddings in Portuguese:
- a set of analogies translated from English!
  - only measuring what is common between the two languages
  - bringing concepts that are more important in English than in Portuguese to the fore: American states, queens, ...
  - even committing errors/translationese
- a set of pairs from semantic domains coming from Portuguese lexical ontologies: TALES (Gonçalo Oliveira et al., 2020)
  - preference by number of different ontologies a specific relation occurs in: entries were selected, first, according to their presence in several lexical resources for Portuguese,

Concluding

- Values are essential in human language, which is human-centered.
- Human language and human intelligence do not need to be transferred to machines: cooperation and mutual understanding should be enough.
- To transfer to English all communication instead of allowing many different cultures to think and act is a big mistake (cultural epistemocide, Boaventura Sousa Santos, 2014).
Questions? Doubts? Disagreements?

Thank you!

References


Santos, Diana. “Grandes quantidades de informação: um olhar crítico”. Palestra no HD-Rio 2020/2021, 14 de abril de 2021. https://www.youtube.com/watch?v=Qi-3QzP0NxM0


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