OXFORD UNIV.
Dep Psychiatry

MANCHESTER UNIV.
School Computer Sci

DEEP COGNITO

Longitudinal modelling of real-world data: the UK-CRIS data story

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1) Annotators
2) Named entity recognition
3) Few Shots learning
4) Effects of medication
5) Longitudinal sleeping patterns

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Clinical annotators

CRIS NETWORK

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Enabling artificial intelligence in mental health

UK-CRIS is the world largest mental health record (14 NHS trusts) that can be used in research. Most of the medical information (such as drug dosages, medical scores, symptoms…) resides in free text notes, and needs to be extracted with artificial intelligence algorithms (see Figure), which learn from medical experts themselves. Would you like helping us in this task?

We need your medical expertise to teach our artificial intelligence algorithms. You will be tasked with annotating medical records in UK-CRIS, which have been written by other doctors during patient visits. Annotating consists on marking in the text a number of clinically relevant pieces of information (e.g. which drug dosages, medical scores and symptoms the patient had). You can do these annotations from any NHS computer in Oxford Health trust. You will be asked to annotate an amount of text equivalent to 240 DIN A4 pages of Arial 10. We estimate this will require 20 hours of your time, and should be completed within 3 months of signing up. These figures can however be negotiated.

Your contribution to the project will be acknowledged in the author list of the peer review journal publications that emerge from this project. There will be opportunities for you to lead a research question yourself, and we will closely support you on this

If interested, please contact kate.saunders@psych.ox.ac.uk and mention the UK-CRIS artificial intelligence project.

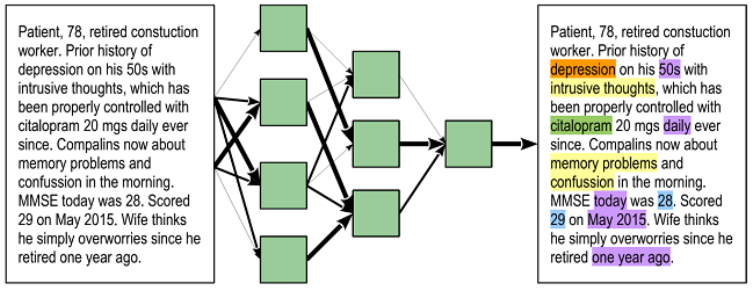
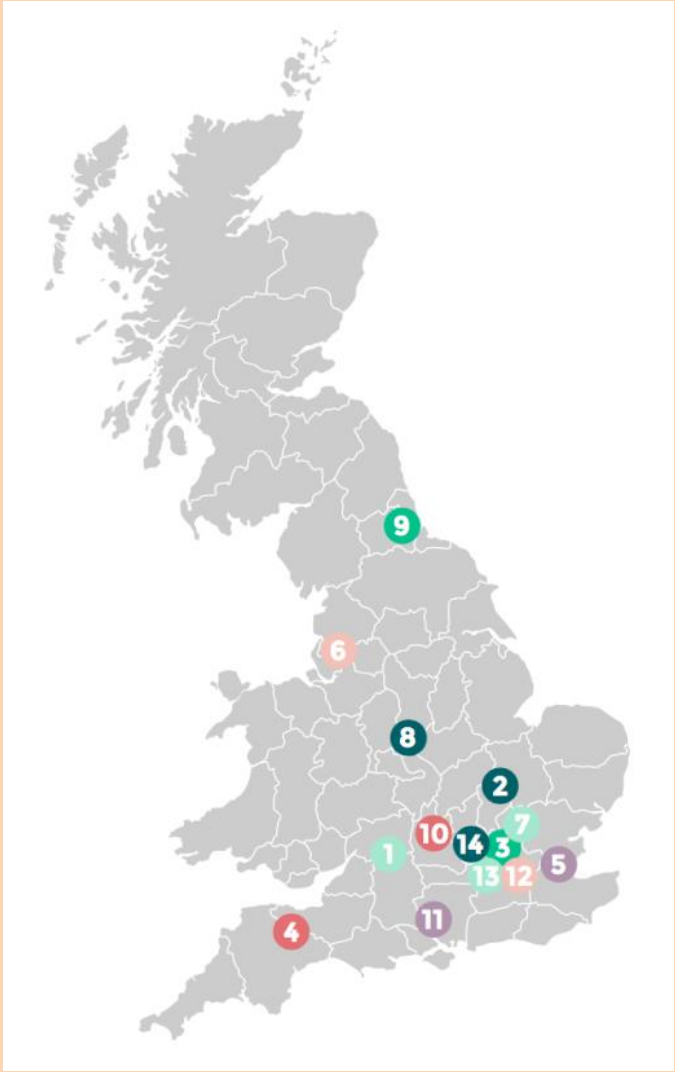
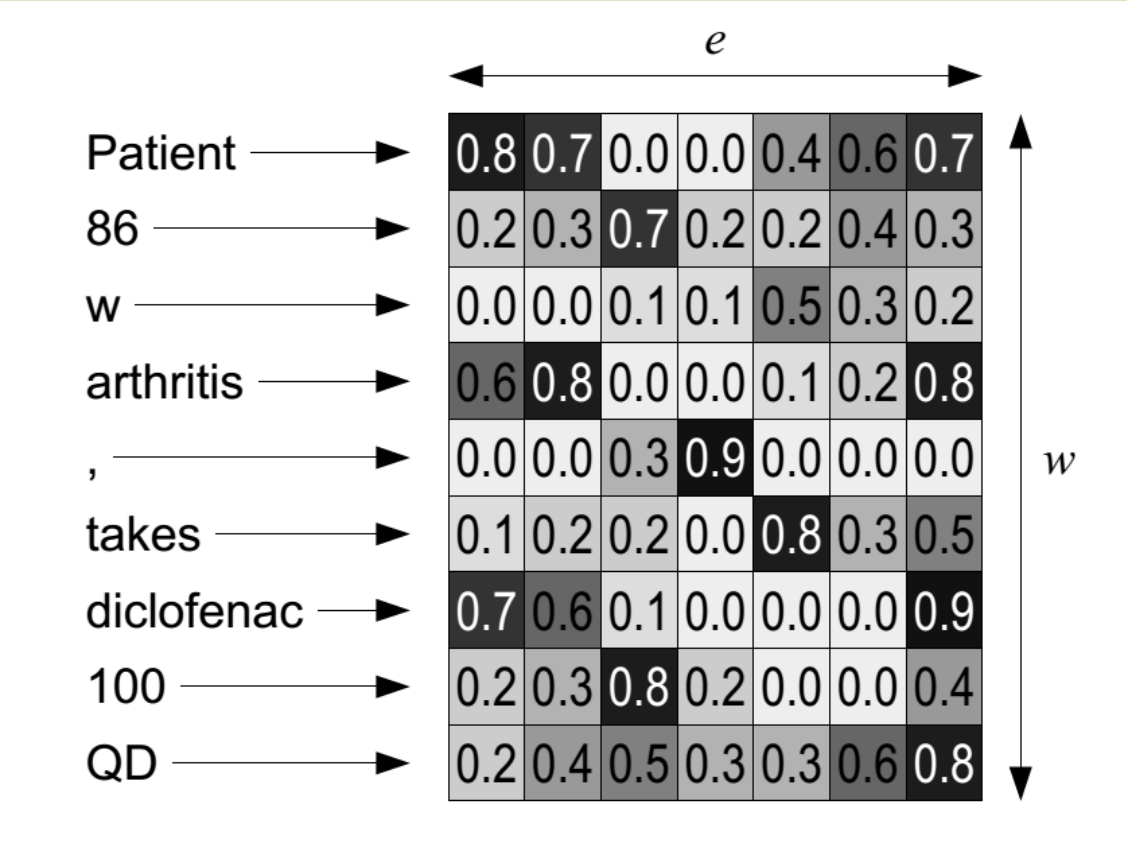


Figure: Schematic representation of unannotated text (left) being analysed by a neural network (green cells) to automatically annotate it (right).



CRIS NETWORK

Named entity recognition



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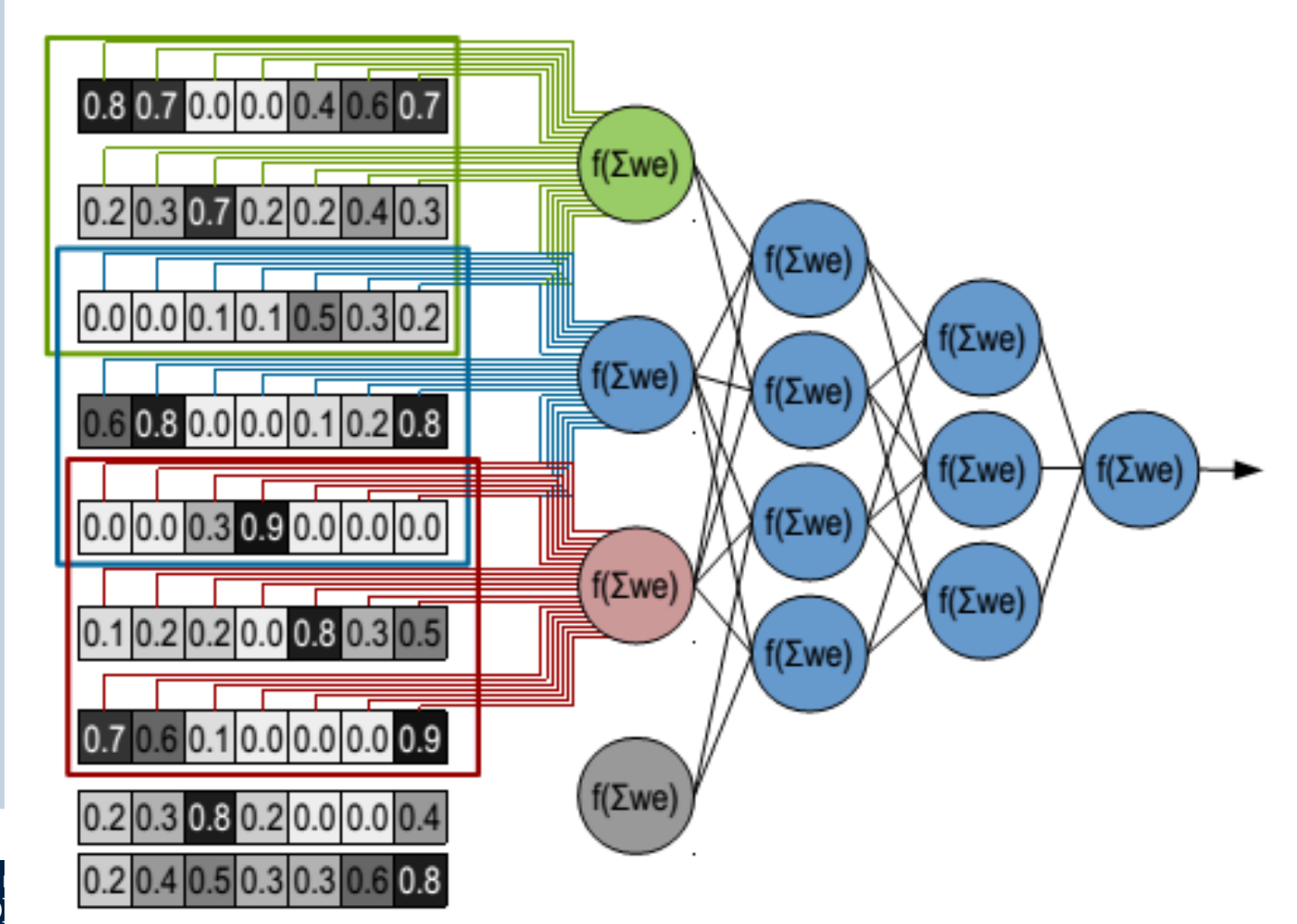
Named entity recognition



Named entity recognition

Term	Context free FFN	Context aware FFN	RNN	I2B2 winner
Medication	79.0	88.9	**94.6**	90.3
Dosage	71.0	91.0	**93.0**	90.8
Mode	95.4	92.7	**96.9**	89.3
Frequency	79.8	88.5	**90.9**	87.7
Duration	31.7	61.9	**63.0**	56.0
Reason	26.5	28.1	28.4	**47.0**

Table 6: Performance on I2B2 2009 objective task. The table shows F1 scores for each of our three architectures on extracting each of the target terms of I2B2 2009. For comparison, results of the winners of I2B2 challenge are also provided in the last column.

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Luka Gligic

Few Shots learning

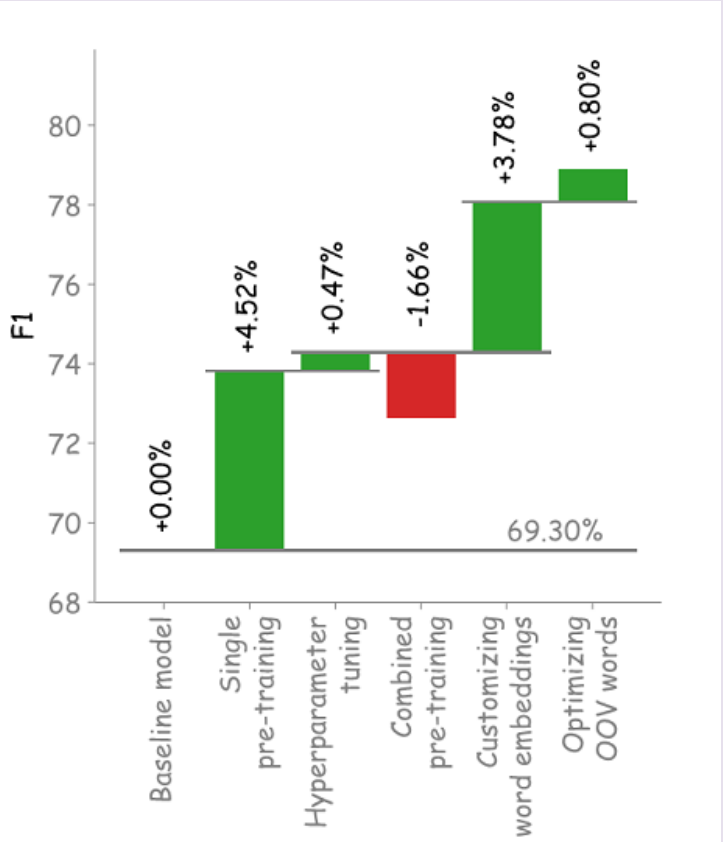
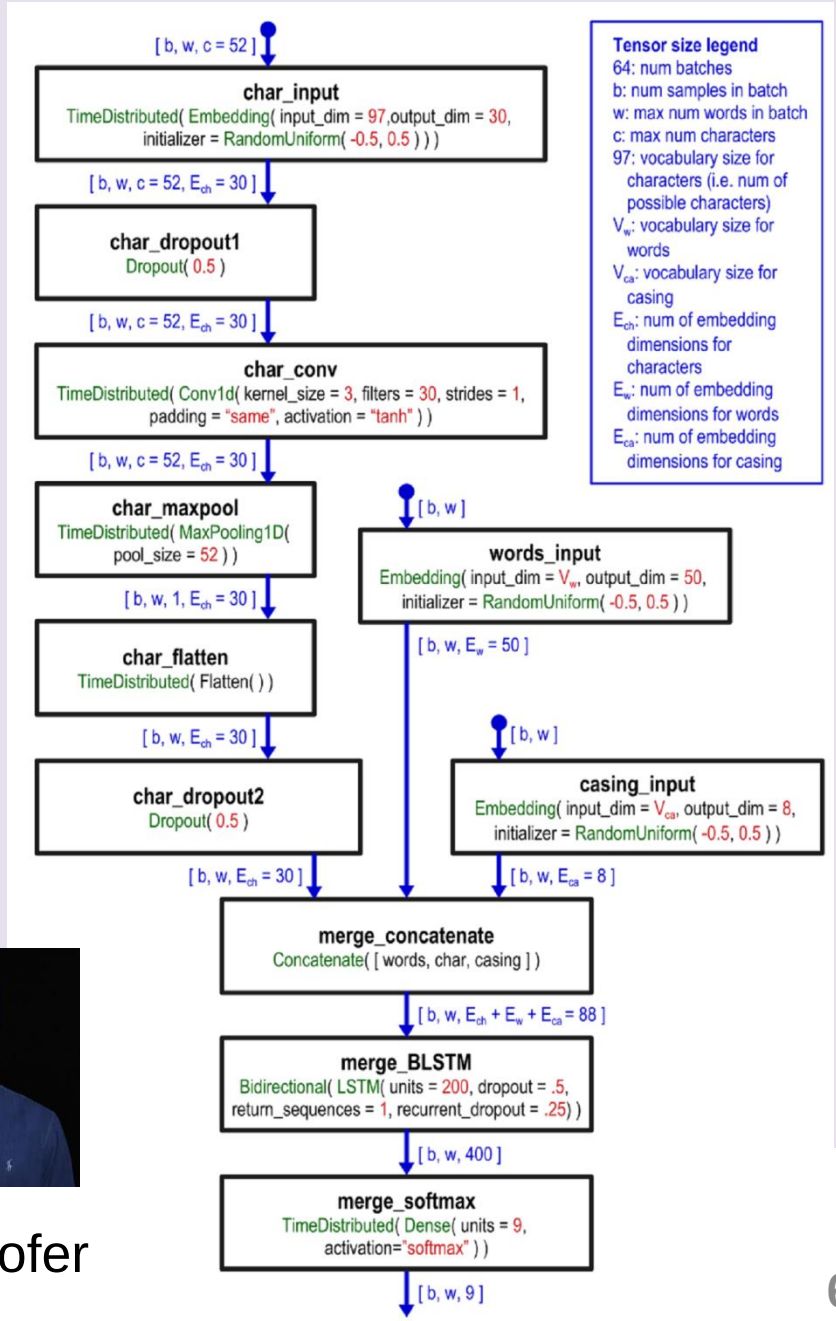


Figure 4. Summary. *The figure shows the increase (green) or decrease (red) in performance (y-axis) produced after each improvement (x-axis). Baseline F1 score is 69.3% and the final F1 score is 78.87%.*

Max Hofer

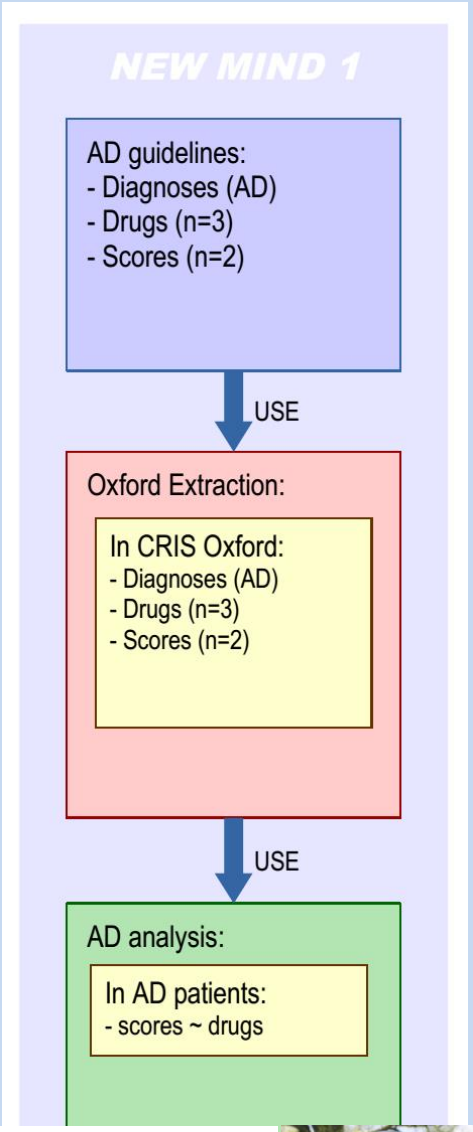


Effects of medication

Extracted information:

- 1 Disease: Alzheimer
- 1 Centre: Oxford NHS Mental HealthTrust
- 5 variables: 3 drugs, 2 mental scores

Atribute	AD diagnosis	Medications
Concept	92.05% (F1)	98.05%
Experiencer	94.18%	98.68%
Negation	96.23%	96.69%
Opinion by …	96.92%	99.34%
Severity	92.81%	
Cause	99.31%	
Date	90.75%	



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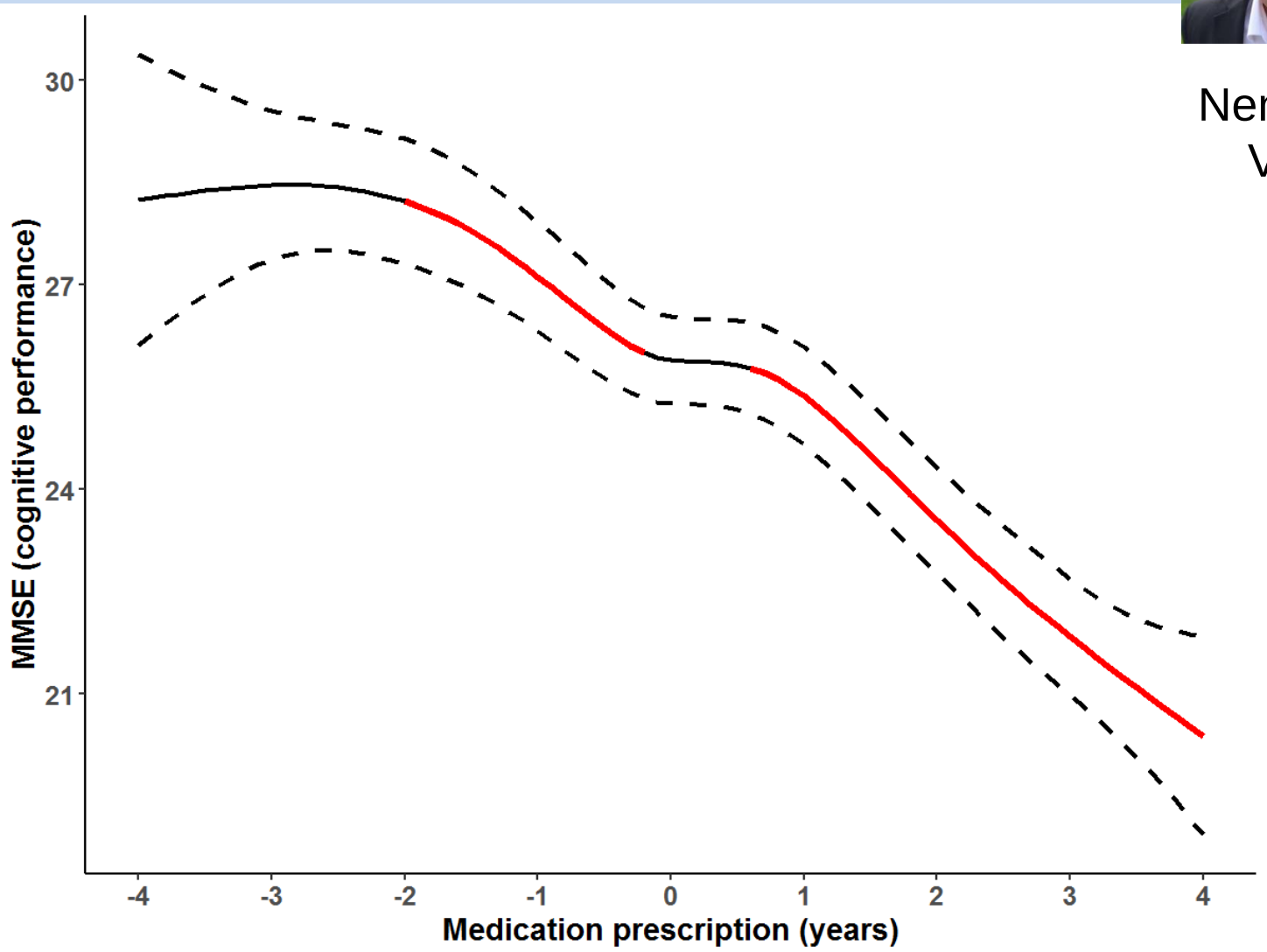
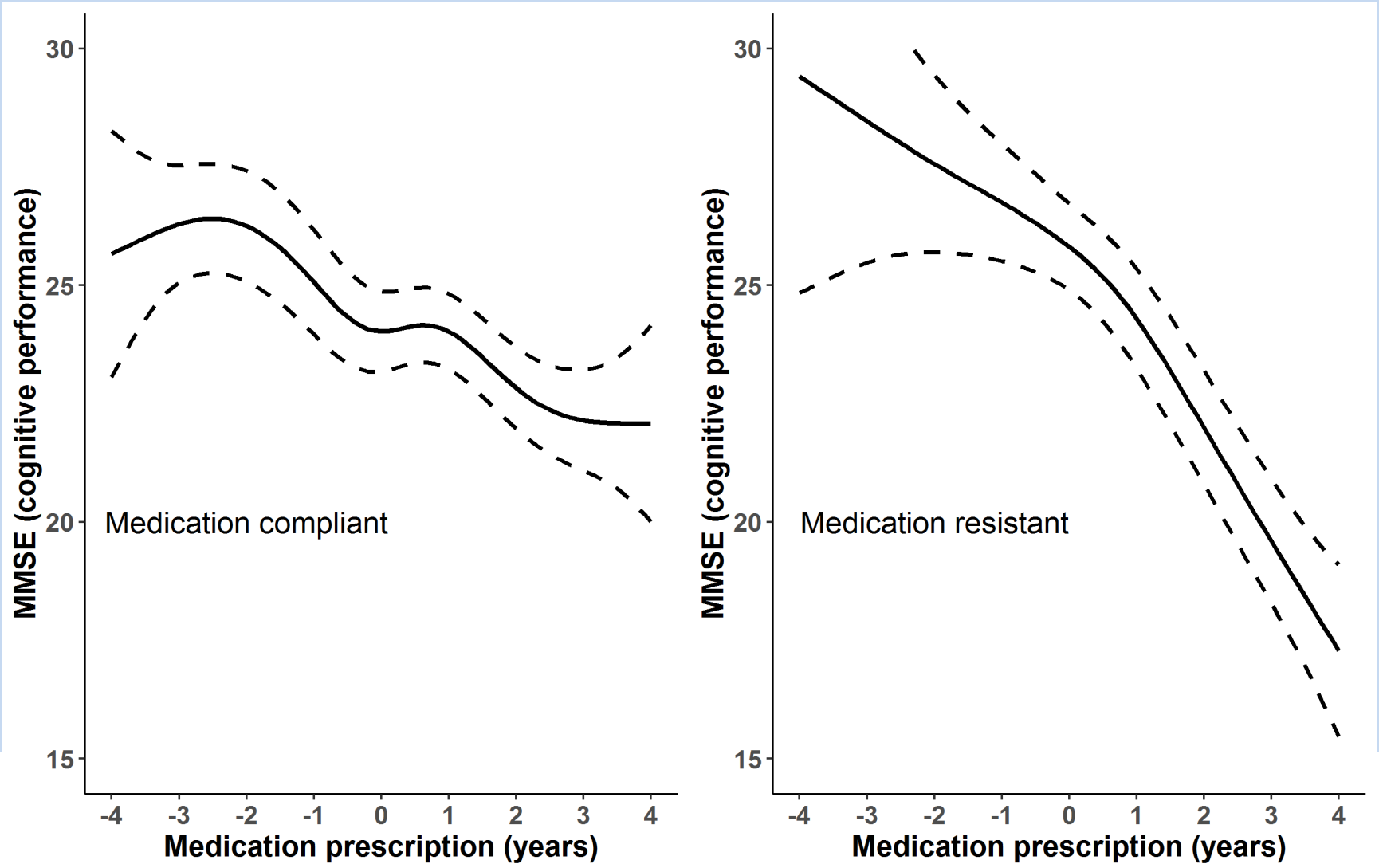
Andrey Kormilitzin

Effects of medication

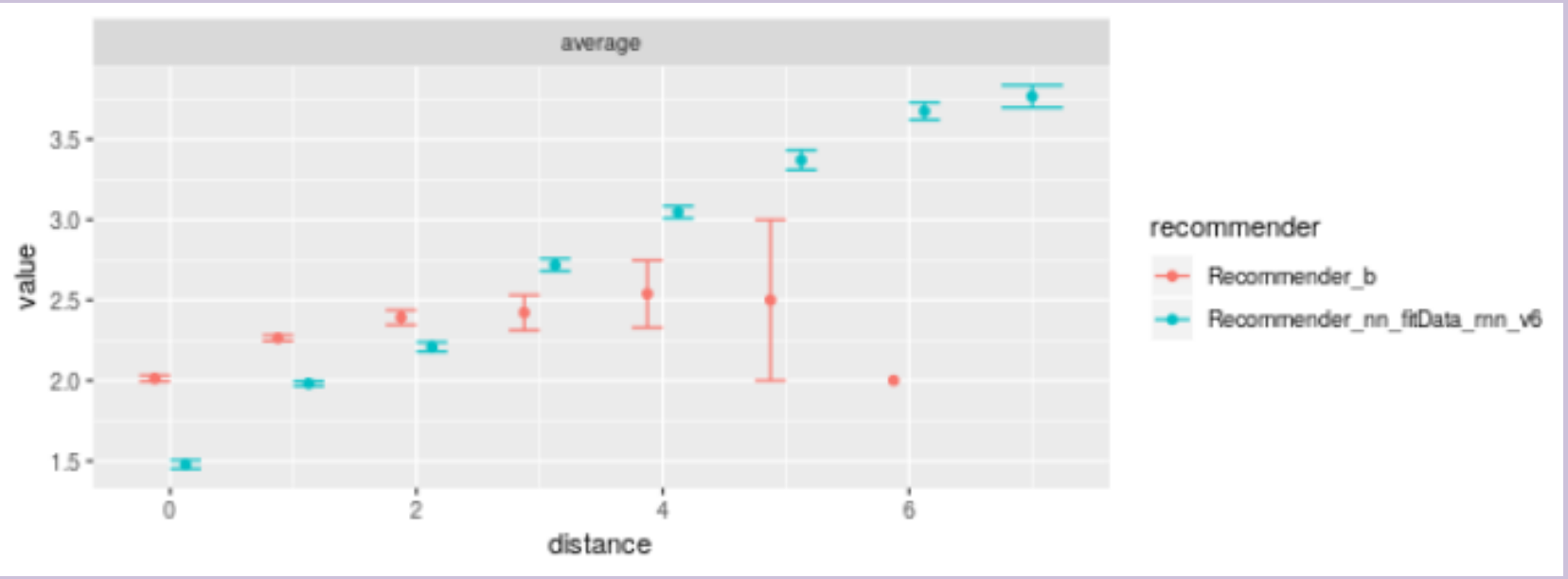
Nemanja Vaci

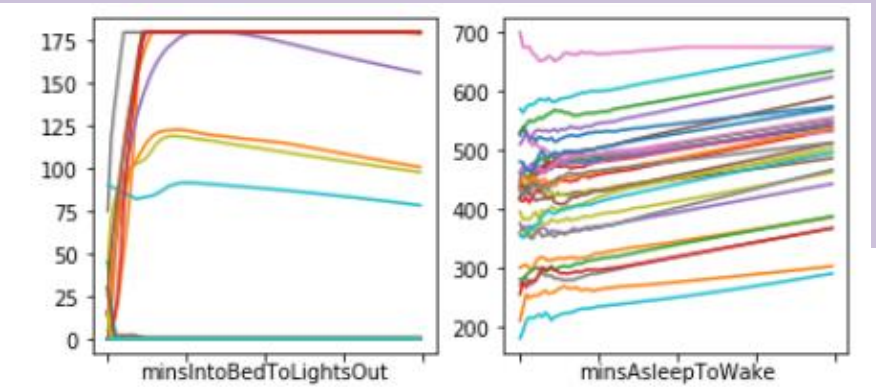


Effects of medication



Longitudinal sleeping patterns





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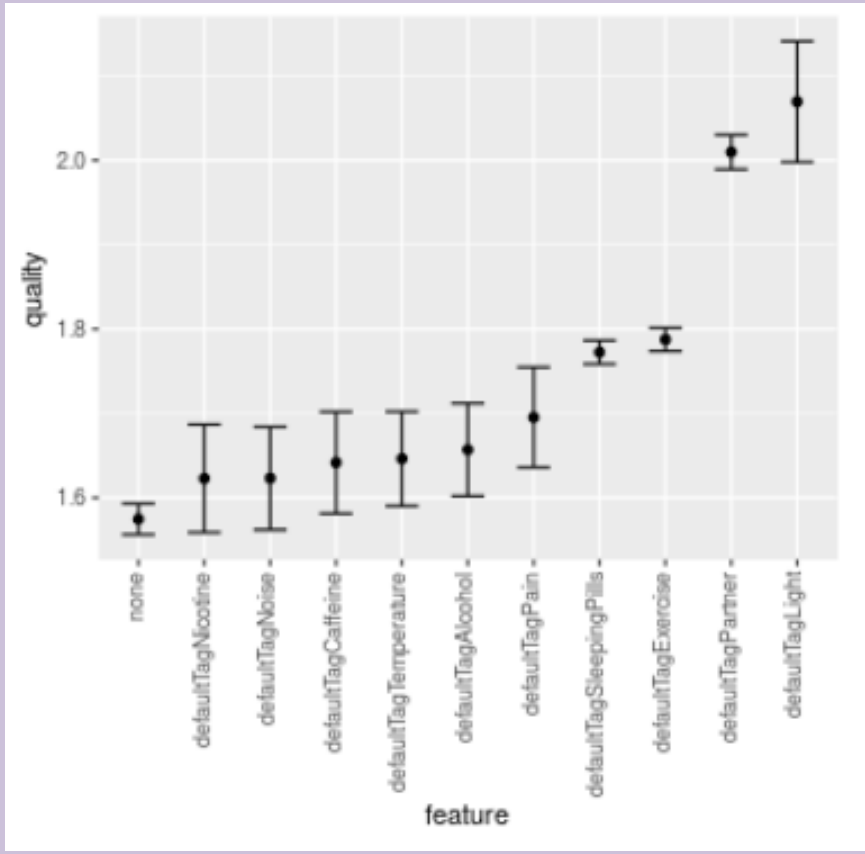
Longitudinal sleeping patterns



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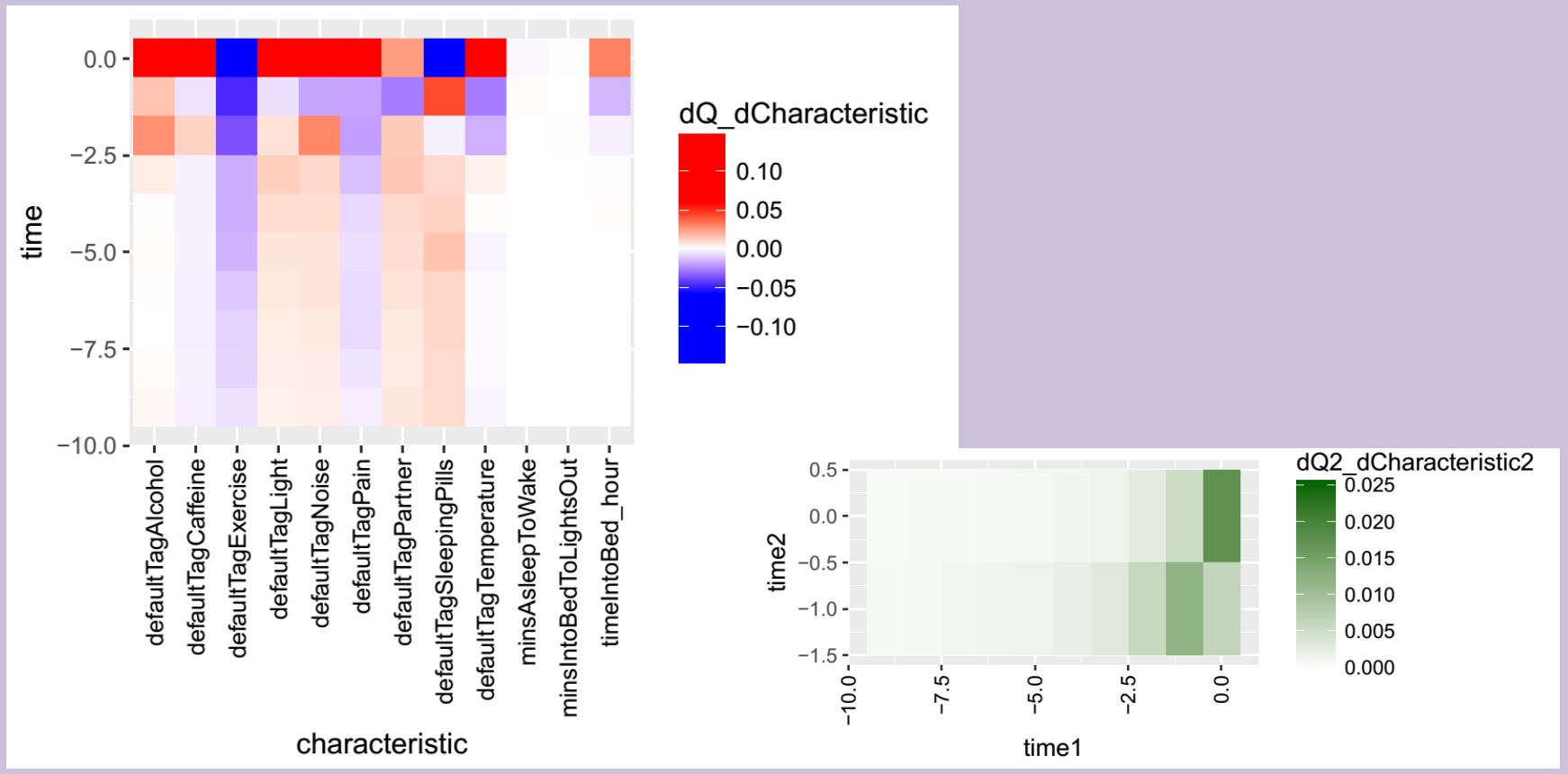
Longitudinal sleeping patterns



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Conclussions

- Current NLP can reliably extract diagnoses, medications, and related information (dosage, frequency, mode of administration…) when hundreds of annotated samples are available
- Future NLP needs to improve performance when very few annotated samples are available
- AD medications seem to improve baseline cognitive performance in a large class of AD patients
- But another class of AD patients don’t seem to benefit from medication and decline the fastest

Many thanks!

Simon Lovestone
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Liu Shi
and many more