



Universiteit
Leiden
The Netherlands

Natural language processing in healthcare: applications and value

Buchem, M.M. van

Citation

Buchem, M. M. van. (2024, December 11). *Natural language processing in healthcare: applications and value*. Retrieved from <https://hdl.handle.net/1887/4172376>

Version: Publisher's Version

[Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

License: <https://hdl.handle.net/1887/4172376>

Note: To cite this publication please use the final published version (if applicable).

Natural Language Processing in Healthcare: Applications and Value

Marieke Meija van Buchem

Copyright 2024 © Marieke van Buchem

All rights reserved. No parts of this thesis may be reproduced, stored in a retrieval system or transmitted in any form or by any means without permission of the author.

Provided by thesis specialist Ridderprint, ridderprint.nl

Printing: Ridderprint

Layout and design: Erwin Timmerman, persoonlijkproefschrift.nl

Cover: Reinier van Buchem

Natural Language Processing in Healthcare: Applications and Value

Proefschrift

ter verkrijging van
de graad van doctor aan de Universiteit Leiden,
op gezag van rector magnificus prof.dr.ir. H. Bijl,
volgens besluit van het college voor promoties
te verdedigen op woensdag 11 december 2024
klokke 10:00 uur
door

Marieke Meija van Buchem
geboren te Princeton, Verenigde Staten
in 1995

Promotor

Prof. Dr. E.W. Steyerberg

Copromotores

Dr. I.M.J. Kant Universiteit Utrecht

Dr. M.P. Bauer

Promotiecommissie

Prof. Dr. A.M. Stiggelebout

Prof. Dr. M.R. Spruit

Prof. Dr. S. Verberne

Prof. Dr. A. Abu-Hanna Universiteit van Amsterdam

‘It’s only complicated if you start thinking about it.’

Alan Watts

Table of contents

1	Introduction	9
1.1	Natural language processing	11
1.2	Healthcare data	14
1.3	Research questions	15
1.4	Outline	16
1.5	Terminology	17
Part 1: application of natural language processing in various healthcare settings		
2	The digital scribe in clinical practice: a scoping review and research agenda	23
3	Natural language processing methods to identify oncology patients at high risk for acute care with clinical notes	49
4	Analyzing patient experiences using natural language processing: Development and validation of the artificial intelligence patient reported experience measure (AI-PREM)	71
5	Applying natural language processing to patient messages to identify depression concerns in cancer patients	97
6	Artificial intelligence–enabled analysis of statin-related topics and sentiments on social media	121
Part 2: evaluating the added value in clinical practice		
7	The added value of the artificial intelligence patient-reported experience measure (AI-PREM tool) in clinical practise: Deployment in a vestibular schwannoma care pathway	151

8	Impact of a digital scribe system on clinical documentation time and quality: usability study	175
Part 3: general discussion and summary		
9	General discussion	197
9.1	Promising applications	199
9.2	Challenges during development	203
9.3	Value for clinical practice	207
9.4	Future outlook	212
9.5	Recommendations	214
9.6	Conclusion	215
10	Summary	225
11	Samenvatting	231
Appendices		239
Publications		241
Curriculum vitae		248
Dankwoord		247