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## Learning to look at LiDAR: combining CNN-based object detection and GIS for archaeological prospection in remotely-sensed data

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## Curriculum Vitae

Wouter Baernd Verschoof-van der Vaart was born on April 6<sup>th</sup>, 1987 in Utrecht, the Netherlands. In the summer of 2005 he graduated from the Christelijk Gymnasium Utrecht, after which he started his Bachelor's studies Archaeology at Leiden University. In 2008 he obtained his Bachelors and started on his Master's studies Archaeology at the same. During his studies, he participated in extracurricular organizations and obtained a job as an junior field archaeologist at at *RAAP Archeologisch Adviesbureau*.

After graduating in 2011 he worked as an archaeologist, geophysicist, and GIS-expert at *RAAP Archeologisch Adviesbureau* for six years. Coming back to Archaeology at Leiden University in 2017 for a PhD research project in the Data Science Research Programme on the use of Deep Learning for the automated detection of archaeology in remotely-sensed data under the supervision of Dr. Karsten Lambers. The results of this research project are described in this thesis.

His interest in this field has led to a post-doc position at Leiden University in the Heritage Quest project, a scholarship from the *Lehrstuhl Geopedologie und Landschaftsentwicklung* at the Brandenburg University of Technology Cottbus-Senftenberg (Germany), and an Elise Mathilde Funt grant from the Leiden University Fund for his *Scars of War* project.



## Acknowledgments

Then suddenly your quest has ended... my four-year adventure of researching and writing is done. A very weird feeling, especially after working from home for the last one-and-a-half years of it due to the Coronavirus Pandemic. But if this PhD project (and playing Dungeons&Dragons for over 20 years) has taught me anything, it is that you can never finish a quest alone. To all fellow researchers and students that I have encountered over the years: Thank you!

First, I would like to express my gratitude to my main supervisor and "quest giver" (every adventure needs one) **Karsten Lambers**. Thank you for giving a commercial field archaeologist with almost no programming skills a chance to do a PhD in computational archaeology and data science. You have always been supportive of my work and time-and-again managed to improve my research. I feel that we have both grown during this PhD project, from a slightly awkward couple of researchers to a well-oiled team and friends. Many thanks also to **Wojtek Kowalczyk**, your refreshing (non-archaeological) perspective and contributions were invaluable. Furthermore, I would like to express my gratitude to **David Fontijn**. Unfortunately, you were my second supervisor for a only short time. Nevertheless, your comments on the Introduction helped improving it greatly. I would also like to thank **Jan Kolen** for stepping in and joining as second supervisor for the last leg of the journey. And of course I would also like to thank my committee: **Ariana Traviglia**, **Marie Soressi**, **Bert Groenewoudt**, **David Fontijn**, **Joost Batenburg**, **Raymond Corbey**, and **Tuna Kalayci** for reviewing my thesis and for participating in my defense. Also a big thanks to my two paranymphs, **Alex Brandsen** and **Steven van Driel**. I am sure you two will defend my honor if needed.

Over the course of my PhD project I had the pleasure of working together with many wonderful and inspiring colleagues at not one but two research groups. Thanks to all the colleagues from Data Science for the coffee talks, lunches, murder mysteries, and *intervisie*. I particularly enjoyed listening to all our widely different research

projects during the lunches! A word of gratitude to the PhD community and colleagues at Archaeology and in particular to my office mates **Anne, Julia, Marina, and Alex**, and my fellow RPG nerds **Irini, Alex, Erik, Jip, and Valerio**. Hopefully, we can soon continue our adventures! Of course also a thank you to the many other researchers I had the pleasure of meeting and working with during my PhD, such as **Agnes Schneider, Iris Kramer, Sarah Klassen, Apostolos Sarris, Dave Cowley, Gertjan Plets, Marco Fiorucci, Martin Olivier, Øivind Trier, Philip Verhagen, Ralf Hesse, and Žiga Kokalj**.

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**Alex**, my partner in crime! We have known each other for many years, going all the way back to 2005. One of the many perks of this PhD project was getting back in touch with you. I couldn't have done it without, in the least because your skill points in Python far outreach mine. I hope there will be many more desk sieges in our future! Maybe we can bring the "emotional support trebuchet" to our defenses?

Of course, a PhD is not all about research and luckily I scored a "critical hit" when it comes to all my friends. **Dave, Gijs, Harrie, Jesse, Joost, Lykele, Maarten, Mulders, Paul, Steven en Sus** a.k.a. the "nerds", thanks for listening to my often incomprehensible ranting about CNNs, LiDAR, and other random acronyms. Thank you for the many relaxing game nights and weekends that took my mind of my research. Also a thank you to all the other "Utrecht friends", such as **Anne (2x), Christine, Eline, Jessica, Jonneke, Minou, Sharon, Tjitske, Arnout, Kaz, and Lucas**, and the "other friends" such as **Femke, Kayleigh, Maaïke, Arjan, Patrick, Stijn, and Tim** for their interest and support.

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And last but certainly not least, I would like to thank the loves of my life, my wife **Sasja** and my daughter **Leena**. Sasja, if I ever rolled a "natural 20" it was when I met you. I love you. I could not have done this without you!