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# BENJAMIN DOURTHE, PhD

Passionate Machine Learning Engineer | Innovator in Computer Vision | Team Leader

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Versatile and dedicated machine learning engineer with a decade of experience across diverse domains, specializing in cutting-edge technologies to drive innovative solutions. Recognized for spearheading the development of groundbreaking technologies. Strong leadership skills and a proven track record of delivering exceptional results through collaboration and effective team management.

By combining technical and domain expertise in machine learning, data analysis, programming and healthcare, I have achieved significant advancements in medical image analysis, automating complex processes and revolutionizing patient care. My passion for leveraging cutting-edge technologies, driving collaboration, and leading teams allows me to consistently deliver exceptional results.

## TECHNICAL SKILLS

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**Machine Learning:** Strong expertise in classification, regression, clustering, optimization, natural language processing, and deep learning techniques.

**Data Analysis:** Proficient in performing image/signal processing, time series analysis, computer vision, feature engineering, and statistical analysis using Python.

**Programming:** Extensive hands-on experience in Python frameworks like NumPy, Pandas, Scipy, OpenCV, Scikit-learn, TensorFlow, and PyTorch. Basic understanding of Matlab, R, SQL, and Git, with a strong desire to expand and apply these skills in future projects.

**Interpersonal Skills:** Strong leadership, project management, and team collaboration skills with a proven track record of successful projects. Excellent scientific writing and public speaking abilities in both English and French.

## EDUCATION

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- **PhD in Biomedical Engineering**, KU Leuven, Leuven, Belgium, April 2014 - June 2017
- **Visiting Scholar**, University of British Columbia, Vancouver, Canada, October 2016 - November 2016
- **Visiting Scholar**, University of Southern California, Los Angeles, USA, August 2015 - December 2015
- **MSc in Science, Technology and Health**, University of Lorraine, Metz, France, September 2012 - June 2013
- **MSc in Mechanical Engineering**, National Engineering School of Metz (ENIM), Metz, France, September 2008 - June 2013

## PROFESSIONAL EXPERIENCE

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**SENIOR MACHINE LEARNING ENGINEER at Nuralogix Corporation (Toronto, Canada), November 2022 - June 2023 (8-month contract)**

- Spearheaded the development and optimization of more than 10 advanced signal processing and filtering algorithms, elevating video data quality by 25% and bolstering accuracy, performance, and generalization of machine learning models.
- Engineered an extensive array of over 100 signal-based features, thereby generating comprehensive and intricate high-dimensional representations of input video data.
- Developed and fine-tuned a machine learning pipeline, leveraging advanced methodologies such as hyperparameter optimization, cross-validation, and feature selection methods, to seamlessly classify input video data and effectively identify the most accurate regression model. This refined approach led to a remarkable 12% enhancement in biometric prediction performance.

**CHIEF DATA OFFICER at Tidal Medical (Toronto, Canada), August 2020 - October 2022 (2 years and 3 months permanent position)**

- Developed a non-invasive wearable system for monitoring pulmonary artery pressure in heart failure patients, achieving 97% accuracy compared to ground truth invasive measurements through the application of signal and image processing algorithms.
- Implemented a Super Resolution Generative Adversarial Network (SRGAN) to enhance the resolution of dynamic cross-sectional chest images while preserving clinically relevant details.
- Leveraged advanced signal processing techniques and cutting-edge deep learning methods for computer vision to optimize the software architecture, improving system efficiency by 90%.
- Led and managed the engineering team to develop a functioning beta prototype, hiring and overseeing two senior developers, two independent contractors, two academic partners, and two contracting firms to enable company growth.
- Directed the company's intellectual property strategies, filing 1 PCT and 4 provisional applications through the USPTO. Conducted detailed literature reviews and background research of analogous technologies to inform IP development.
- Managed \$1.5M in capital and secured \$700k in non-dilutive funding over a two-year period. Contributed to the creation of a comprehensive data room, including competitor analysis, literature review, product overview, and business strategy.

*Corporate & Academic partners: Sciospec Scientific Instruments GmbH, EngineeringCPR, Stanford University, University of Waterloo, Carleton University, University of Toronto, Experien Group, Osler, FBFK, Canadian Space Agency*

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**MACHINE LEARNING ENGINEER at University of British Columbia (Vancouver, Canada), June 2020 - December 2022 (2 years and 7 months post-doctoral contract)**

- Developed and implemented advanced deep learning models to automate the segmentation and labeling of medical images, revolutionizing a previously time-consuming process. Notable achievements include the adaptation of a Multi-scale V-net, enabling automatic segmentation of spinal muscles with diverse morphology, shape, and size, as well as the implementation of a Universal Convolutional Neural Network (CNN) to extract the coordinates of vertebral body centroids from CT images.
- Through the utilization of these cutting-edge models, achieved a remarkable reduction in processing time from hours to mere seconds, delivering a substantial boost to data analysis efficiency. This breakthrough advancement greatly empowered clinicians in generating tailored and effective treatment plans, significantly elevating the potential for successful outcomes in patient care.

*Supervisor: Dr. Tom Oxland.*

*Corporate partners: Medtronic (global leader in medical technology, services, and solutions).*

**COMPUTER VISION ENGINEER at Sunnybrook Research Institute (Toronto, Canada), December 2018 - June 2020 (1 year and 7 months post-doctoral contract)**

- Collected and analyzed data using a diverse range of motion capture technologies, including infrared cameras with retroreflective markers (gold standard), marker-less infrared depth sensors, as well as standard RGB cameras powered by deep learning.
- Developed a custom deep learning model based on the Mask RCNN architecture, which was retrained using transfer learning techniques for the accurate detection and tracking of 24 body segments from 2D videos. Achieved great performance compared with gold standard 3D marker-based technology.
- Implemented a robust deep learning solution utilizing a Recurrent Neural Network (RNN) with Long Short-Term Memory (LSTM) units to define a transfer function. This transfer function effectively learned from gold standard motion tracking data, resulting in a remarkable 35% improvement in accuracy for marker-less motion tracking systems.

*Supervisor: Dr. Carry Whyne.*

**DATA SCIENTIST at University of Calgary (Calgary, Canada), October 2017 - November 2018 (1 year and 2 months post-doctoral contract)**

- Collaborated with prominent companies such as Adidas, Dr. Scholl's, and various startups to evaluate the impact of apparel and footwear on human performance and fatigue. Designed and implemented comprehensive data processing platforms to facilitate the efficient handling, analysis, and visualization of extensive datasets.
- Collected, processed, and analyzed data from diverse sensor sources, including pressure sensors, inertial measurement units (IMUs), electromyography (EMG), 3D contact-less scanners, and mechanical testing equipment.
- Applied advanced signal processing techniques and statistical tools to gain insights and quantitatively assess the impact of each intervention. Generated detailed reports for corporate partners, providing valuable recommendations based on the analysis results.

*Supervisor: Dr. Benno M. Nigg.*

*Corporate partners: Dr. Scholl's (footwear and orthotics), Adidas (athletic footwear, clothes & accessories), CCM Hockey (sports equipment and virtual coaching systems), Orpyx Medical Technologies Inc. (sensor-based technologies for medical and athletic applications), Per4ma (compression garments).*

**VISITING SCHOLAR at University of British Columbia (Vancouver, Canada), October - November 2016 (2 months research stay)**

- Validated a novel medical imaging approach based on contrast-enhanced computer tomography enabling the non-invasive extraction of cartilage properties and facilitating the early detection of osteoarthritis in human joints.

*Supervisor: Dr. David R. Wilson.*

**VISITING SCHOLAR at University of Southern California (Los Angeles, USA), August - December 2015 (5 months research stay)**

- Programmed a computational platform enabling the forward simulation of human motion using medical imaging data for the prediction of joint loading and degeneration.

*Supervisor: Dr. Francisco Valero-Cuevas.*

**RESEARCH ENGINEER at KU Leuven (Leuven, Belgium), April 2014 - June 2017 (3 years and 3 months graduate contract)**

- Conducted groundbreaking graduate research focusing on the development of patient-specific models to predict the onset of degenerative musculoskeletal conditions using medical images.
- Developed and implemented protocols to collect medical imaging data from both patients with degenerative musculoskeletal conditions and healthy individuals. These data served as the foundation for the creation of comprehensive 3D mapping technologies.
- Designed sophisticated image processing algorithms to automate the extraction of patient-specific morphological data from imaging technologies, which played a crucial role in accurately predicting the distribution of mechanical stress in human joints.
- Leveraged the extracted data and predictions to generate insights about the location of future degenerations. This knowledge facilitated the development of tailored preventative and treatment measures, ensuring a more personalized approach to patient care.

*Supervisor: Dr. Evie Vereecke.*

*Corporate partners: Materialise (Medical 3D Printing & Biomedical Engineering), Louise Hand Clinic (Orthopaedic Surgery), University of Southern California (Research), University of British Columbia (Research), Boston University (Research), Harvard Medical School (Research).*

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### **RESEARCH INTERN at National Engineering School of Metz (Metz, France), January - June 2013 (6 months internship)**

- Created a modeling tool enabling the automated simulation of oral pathologies, which contributed to the optimization and improvement of related treatment strategies.

*Supervisor: Dr. Emilie Sapin-de Brosse.*

### **RESEARCH SCIENTIST INTERN at CNRS (Chalon-sur-Saone, France), September - December 2011 (4 months internship)**

- Designed and produced a tailored system enabling laser surface treatments under controlled atmosphere on titanium samples and performed nuclear analysis.

*Supervisor: Dr. Luc Lavis.*

### **RESEARCH ENGINEER INTERN at Welding Institute (Yutz, France), January - June 2010 (6 months internship)**

- Completed mechanical testing reports for consulting industry partners.

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## **MENTORSHIP & TEACHING EXPERIENCE**

- PhD student advisor at University of British Columbia (Vancouver, Canada), June 2020 – December 2022
- Intern advisor at Tidal Medical (Toronto, Canada), August 2020 – November 2022
- Medical student mentor at University of Toronto (Toronto, Canada), December 2018 - June 2020
- Master student mentor at University of Calgary (Calgary, Canada), January – September 2018
- Undergraduate student supervisor at University of Calgary (Calgary, Canada), October – December 2017
- Teaching assistant at KU Leuven (Leuven, Belgium), September 2015 – December 2016
- Project advisor at University of Southern California (Los Angeles, USA), September – December 2015
- Student panel representative at National Engineering School of Metz (Metz, France), September 2009 – June 2012

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## **HONORS & AWARDS**

- Toronto Health Stream Graduate, Creative Destruction Lab (CDL), July 2022
- Deep Space Healthcare Challenge, Canadian Space Agency, June 2022 (\$30,000)
- Research and Development Award, National Research Council of Canada Industrial Research Assistance Program, April 2022 (\$250,000)
- INOVAIT Strategic Innovation Fund, Sunnybrook Research Institute, March 2022 (\$125,000)
- Novel applications of AI and image reconstruction for respiratory and cardiac monitoring (VIP Program), ENCQOR, December 2021 (\$150,000)
- Demonstration Program, ENCQOR 5G, November 2021 (\$50,000)
- Project Grant, Canadian Institutes of Health Research, September 2021 (\$795,600)
- Collaborative Research and Development Grant, The Natural Sciences and Engineering Research Council of Canada (NSERC), January 2018 (\$100,920)
- European Research Foundation Conference Grant, Research Foundation Flanders - FWO (Belgium), January 2017 (€1,300)
- European Research Foundation Visiting Scholar Grant, Research Foundation Flanders - FWO (Belgium), January 2016 (€5,000)
- Conference Grant, Academische Stichting Leuven (Belgium), January 2015 (€500)
- European Research Foundation Visiting Scholar Grant, YouReCa Junior Mobility Programme (Belgium), January 2015 (€4,000)
- Ouvertud Scholarship, Region Lorraine (France), January 2011 (€800)
- Government Scholarship, French Ministry of Higher Education and Research (France), 2009-2013 (€19,500)
- Corporate Scholarships, Group IRP Auto (France), 2009-2013 (€4,000)

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## **PUBLICATIONS, INDUSTRY REPORTS**

- B Dourthe, N Ashjaee, S Fels, TR Oxland. Automated detection of vertebral body centroids from CT-based reconstructed X-ray images using deep convolutional neural network. Unpublished (2023).
  - B Dourthe, S Stowe, A Sawyer. Pulmonary artery pressure estimation using electrical impedance tomography. Tidal Medical (2022).
  - J Toma, A Sawyer, S Pelletier, C Pallopson, B Dourthe, S Stowe, A Adler, B Grychtol. Upsampling technique for generating electrical impedance tomography frames with increased temporal resolution. Tidal Medical (2022).
  - B Dourthe, N Shaikh, S A Pai, S Fels, SHN Brown, DR Wilson, J Street, TR Oxland. Automated segmentation of spinal muscles from upright open MRI using a multiscale pyramid 2D convolutional neural network. Spine. 47(16) (2022) 1179-1186.
  - B Dourthe, S Pelletier. Deep learning super resolution approaches for medical imaging enhancement. Tidal Medical (2021).
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- J Toma, A Adler, A Sung, B Dourthe, A Sawyer, S Pelletier, R Ardeshiri, C Pallopson. Method and system for electrical impedance tomography. Tidal Medical (2021).
- B Dourthe, D Burns, D Wasserstein, C Whyne, M Hardisty. Using recurrent neural network for time series regression: towards the enhancement of computer vision-based 3D motion sensing technologies for injury risk assessment. Unpublished (2020).
- B Dourthe, M Brenkel, T Ziegler, LY Wu, D Wasserstein, K Zabjek, T Beach, T Saumur, S Mark Hirsch, C Whyne, M Hardisty. Comparing marker-based 3D motion capture to computer vision-based motion sensing technologies to assess biomechanical variables associated with anterior cruciate ligament injury risk. Unpublished (2020).
- B Dourthe, J Osterloh, V von Tscharnner, S Nigg, B Nigg. Impact of self-selected customized orthotics on lower limbs biomechanics, Prosthetics and Orthotics, Open-Access Peer-Reviewed Chapter (2020).
- B Dourthe, S Nigg, BM Nigg. Highlights of the Fourteenth Footwear Biomechanics Symposium, Dr. Scholl's, Biomechanigg Sport & Health Research (2019).
- B Dourthe, J Osterloh, V von Tscharnner, S Nigg, B Nigg. Impact of self-selected customized orthotics on lower limbs biomechanics and fatigue. *Footwear Sci.* 11 (2019) S22–3.
- S Manz, B Dourthe, S Nigg, B Nigg. The influence of preference grouping methods on characteristics of recreational runners. *Footwear Sci.* 11 (2019) S40–2.
- B Dourthe, R Nickmanesh, DR Wilson, P D'Agostino, AN Patwa, MW Grinstaff, BD Snyder, E Vereecke, Assessment of healthy trapeziometacarpal cartilage properties using indentation testing and contrast-enhanced computed tomography. *Clin. Biomech.* 61 (2019) 181–189.
- J Osterloh, B Dourthe, S Nigg, BM Nigg. Measuring fatigue-induced changes in walking kinematics: impact of different insole configurations. Master Thesis Chapter, Unpublished (2019).
- B Dourthe, J Osterloh, S Nigg, F Hoitz, BM Nigg. Quantifying the effects of different insole configurations on fatigue and comfort- Phase 3: Results following a sub-hour inclined power walking intervention, Dr. Scholl's, Biomechanigg Sport & Health Research (2018).
- B Dourthe, J Osterloh, S Nigg, BM Nigg. Quantifying the effects of different insole configurations on fatigue and comfort- Phase 2: Results following a 45-minute power walking intervention, Dr. Scholl's, Biomechanigg Sport & Health Research (2018).
- A Meixner, B Dourthe, S Nigg, BM Nigg. Comparison of a newly introduced pressure insole to existing foot pressure measurement technologies, Orpyx Medical Technologies Inc., Biomechanigg Sport & Health Research (2018).
- A Meixner, V von Tscharnner, B Dourthe, S Nigg, BM Nigg. Advanced analysis of the EMG data of the vastii muscles during treadmill running, Biomechanigg Sport & Health Research (2018).
- B Dourthe, S Nigg, A Meixner, J Osterloh, F Hoitz, BM Nigg. Quantifying the effects of different insole configurations on fatigue and comfort- Phase 1: Results following a single working shift intervention, Dr. Scholl's, Biomechanigg Sport & Health Research (2018).
- B Dourthe, S Nigg, C Lam, JR Fletcher, A Martinez, O Omu, BM Nigg. Effect of compression apparel on variables associated with performance, posture, comfort and fatigue, Per4ma Sports Technology LTD, Biomechanigg Sport & Health Research (2018).
- P D'Agostino, B Dourthe, F Kerkhof, F Stockmans, E Vereecke, Impact of osteoarthritis and total joint arthroplasty on the kinematics of the trapeziometacarpal joint: a pilot study. *J. Hand Surg.* 43 (2018) 382.e1–382.e10.
- P D'Agostino, B Dourthe, F Kerkhof, GH van Lenthe, F Stockmans, E Vereecke, In vivo biomechanical behavior of the trapeziometacarpal joint in healthy and osteoarthritic subjects. *Clin. Biomech.* 49 (2017) 119–127.
- P D'Agostino, B Dourthe, F Kerkhof, F Stockmans, E Vereecke, In vivo kinematics of the thumb during flexion and adduction motion: Evidence for a screw-home mechanism. *J. Orthop. Res.* 35 (2017) 1556–1564.
- B Dourthe, FJ Valero-Cuevas, P D'Agostino, F Kerkhof, E Vereecke. Towards a forward simulation of transverse loading of the trapeziometacarpal joint. Dissertation Chapter, Unpublished (2016).
- F Stockmans, B. Dourthe, O Vanovermeire, M Deillie, J Vanhaecke, P D'Agostino, E Vereecke, F Kerkhof, Influence de la reconstruction du ligament radio-dorsal sur la stabilité de l'articulation trapeziometacarpien. *H. Surg. Rehab.* 35 (2016) 453–454.
- F Kerkhof, E Brugman, P D'Agostino, B Dourthe, GH van Lenthe, F Stockmans, I Jonkers, E Vereecke, Quantifying thumb opposition kinematics using dynamic computed tomography. *J. Biomech.* 49 (2016) 1994–9.
- B Dourthe, P D'Agostino, F Stockmans, F Kerkhof, E Vereecke, In vivo contact biomechanics in the trapeziometacarpal joint using finite deformation biphasic theory and mathematical modelling. *Med. Eng. Phys.* 38 (2016) 108–114.

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## CONFERENCE PRESENTATIONS & INVITED TALKS

- Using computer vision sensing technologies for anterior cruciate ligament injury screening, 18th annual Imaging Network Ontario Symposium, Toronto, ON, Canada (poster presentation, March 2020).
  - Impact of self-selected customized orthotics on lower limbs biomechanics and fatigue, 14th biennial Footwear Biomechanics Symposium, Kananaskis, AB, Canada (oral presentation, July 2019).
  - The influence of preference grouping methods on characteristics of recreational runners, 14th biennial Footwear Biomechanics Symposium, Kananaskis, AB, Canada (oral presentation, July 2019).
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- Correlation between thumb cartilage properties and medical imaging, 8th World Congress of Biomechanics, Dublin, Ireland (poster presentation, July 2018).
  - First steps towards the forward modeling of the thumb joint, 8th World Congress of Biomechanics, Dublin, Ireland (poster presentation, July 2018).
  - Electromyography (EMG): technique, applications in Sports and Exercise Sciences, Shad Valley Workshop, Human Performance Laboratory, University of Calgary, Canada (July 2018).
  - Osteoarthritis of the thumb joint: occurrence mechanism and understanding via medical imaging and computer modeling techniques, Human Performance Laboratory Musculoskeletal Biomechanics Seminar, University of Calgary, Calgary, Canada (March 2018).
  - Mechanical properties of healthy trapeziometacarpal cartilage using indentation testing and contrast-enhanced computed tomography, 11th Symposium of the Hand and Wrist Biomechanics International, Brisbane, Australia (oral presentation, July 2017).
  - Comparison between intra-articular contact patterns in the trapeziometacarpal joint of healthy and arthritic subjects. 2017 OARSI World Congress on Osteoarthritis, Las Vegas, NV, USA. (poster presentation, April 2017).
  - Validating thumb kinematics using dynamic CT & in vivo analysis of pathological joint function. Annual Meeting of the Nederlandse Anatomenvereniging, Lunteren, Nederland. (poster presentation, January 2016).
  - In vivo contact stress evaluation in the trapeziometacarpal joint using finite deformation biphasic theory and mathematical modeling. 25th Congress of the International Society of Biomechanics, Glasgow, United Kingdom. (poster presentation, July 2015).
  - Contact patterns in the trapeziometacarpal joint during isometric tasks obtained via mathematical modeling. 21st Congress of the European Society of Biomechanics, Prague, Czech Republic. (oral presentation, July 2015).
  - Analysing thumb kinematics using dynamic CT: the native and pathological joint. 21st Congress of the European Society of Biomechanics, Prague, Czech Republic. (poster presentation, July 2015).
  - Mathematical modeling of the trapeziometacarpal joint for in vivo stress distribution analysis. 9th Symposium of the Hand and Wrist Biomechanics International, Milan, Italy. (oral presentation, June 2015).
  - The trapeziometacarpal joint: form and function of the native and diseased joint. Annual Meeting of the Nederlandse Anatomenvereniging, Lunteren, Nederland. (poster presentation, January 2015).

## PATENTS & PATENT APPLICATIONS

- System and method of monitoring heart failure with electrical impedance tomography, Provisional, 2022
- Increasing effective sampling rate of EIT recordings to improve accuracy of pulse transit time measurements, Provisional, 2022
- Wearable radar system, Provisional, 2022
- Method and system for electrical impedance tomography, PCT WO/2021/223038, 2021
- Artificial intelligence methods to improve predictive capabilities of novel respiratory monitoring system, Provisional, 2020
- Remote monitoring system for respiratory disease, Provisional, 2020

## SIDE PROJECTS

- Developed a natural language processing model that leveraged a Naïve Bayes classifier to accurately classify news articles. Achieved 94% of correct predictions.
- Built a support vector machine model that predicted individuals at risk of developing coronary heart disease, leveraging the synthetic minority oversampling technique (SMOTE) to compensate for class imbalance and reduce type II error by 84%.
- Implemented an algorithm enabling the automated detection and tracking of faces on images and videos using the functionality of Haar cascades and several tracking APIs.
- Applied the concepts of Dense Optical Flow as well as the functionality of the Gunnar Farneback's algorithm to automatically detect and quantify motion from video data.
- Created a computer vision pipeline using the YOLO algorithm combined with transfer learning techniques to track and detect objects from images and videos with high accuracy.
- Developed a notebook with detailed instructions enabling developers to harness the power of the Llama 2 large language model locally for text generation purposes.

## CONTINUOUS LEARNING & SELF DEVELOPMENT

- Building Generative AI Applications with Gradio, DeepLearning.AI, 2023
  - How Diffusion Models Work, DeepLearning.AI, 2023
  - LangChain for LLM Application Development, DeepLearning.AI, 2023
  - Building Systems with the ChatGPT API, DeepLearning.AI, 2023
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- ChatGPT Prompt Engineering for Developers, DeepLearning.AI, 2023
  - Fundamentals of Machine Learning for Healthcare, Stanford University, 2022
  - Master the Coding Interview: Big Tech (FAANG) Interviews, Zero To Mastery Academy, 2022
  - An Entire MBA in 1 Course, Chris Haroun, 2021
  - Probability and Statistics for Business and Data Science, Pierian Data Inc., 2020
  - Python for Financial Analysis and Algorithmic Trading, Pierian Data Inc., 2020
  - 101 Crucial Lessons They Don't Teach You In Business School, Chris Haroun, 2019
  - Python 3 Deep Dive – Object Oriented Programming, Fred Baptiste, 2018
  - Spark and Python for Big Data with PySpark, Pierian Data Inc., 2018
  - Signal Processing Problems, Solved in MATLAB and in Python, Mike X Cohen, 2018
  - Data Science Career Guide - Interview Preparation, Pierian Data Inc., 2017
  - Sequence Modeling, deeplearning.ai, 2017
  - Deep Learning: Advanced Computer Vision, Lazy Programmer Inc., 2017
  - Python for Computer Vision with OpenCV and Deep Learning, Pierian Data Inc., 2017
  - Convolutional Neural Networks in TensorFlow, Pierian Data Inc., 2017
  - TensorFlow Specialization, deeplearning.ai, 2017
  - Complete Tensorflow 2 and Keras Deep Learning Bootcamp, Pierian Data Inc., 2017
  - PyTorch for Deep Learning with Python Bootcamp, Pierian Data Inc., 2017
  - Introduction to TensorFlow for AI, Machine Learning, and Deep Learning, DeepLearning.AI, 2017
  - Cluster Analysis and Unsupervised Machine Learning in Python, Lazy Programmer Inc., 2017
  - Python for Time Series Data Analysis, Pierian Data Inc., 2016
  - Python for Data Science and Machine Learning Bootcamp, Pierian Data Inc., 2016
  - Python and Flask Bootcamp: Create Websites using Flask, Pierian Data Inc., 2016
  - Git & GitHub - The Complete Git & GitHub Course, Code and Create, 2016
  - The Complete SQL Bootcamp, Pierian Data Inc., 2016
  - Complete Python Bootcamp, Pierian Data Inc., 2016
  - Machine Learning, Stanford University, 2016
  - OpenSim International Workshop, Stanford University, 2015
  - Successful Negotiation: Essential Strategies and Skills, University of Michigan, 2015
  - Data Analysis Tools, Wesleyan University, 2014
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