

1. Record Nr.	UNINA9911004753803321
Autore	Hernandez Silveira Miguel
Titolo	Applications of Machine Learning in Digital Healthcare
Pubbl/distr/stampa	Institution of Engineering & Technology, 2022 Stevenage : , : Institution of Engineering & Technology, , 2023 ©2023
ISBN	9781523155378 152315537X 9781839533365 1839533366
Edizione	[1st ed.]
Descrizione fisica	1 online resource (372 pages)
Collana	Healthcare Technologies Series
Altri autori (Persone)	AngSu-Shin
Disciplina	610.285631
Soggetti	Machine learning Medical care - Data processing
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Intro -- Title -- Copyright -- Contents -- About the editors -- 1 Introduction -- 1.1 Why? -- 1.2 How? -- 1.3 What is ML? -- 1.4 The problem -- 1.5 Gradient descent -- 1.6 Structural components of the ANN -- 1.6.1 The fully connected neural network -- 1.6.2 Convolutional neural network -- 1.6.3 Pooling layers -- 1.6.4 The SoftMax function -- 1.6.5 Putting them together -- 1.7 Training and evaluating a neural network -- 1.7.1 Data organisation -- 1.7.2 Types of errors and useful evaluation metrics -- 1.7.3 ADAM optimisation for bias reduction -- 1.7.4 Regularisation for variance reduction -- 1.8 Conclusion -- References -- 2 Health system planning and optimisation - advancements in the application of machine learning to policy decisions in global health -- 2.1 Model-based decision making -- 2.2 ML surrogates for prediction from epidemiological models -- 2.2.1 Gaussian process regression -- 2.2.2 Action-value function example -- 2.2.3 Epidemiological model calibration -- 2.2.4 Bayesian optimisation -- 2.3 Online learning -- 2.3.1 Stochastic multi-armed Bandit -- 2.4 Running epidemiological simulations as Bandits -- 2.4.1 Time -- 2.4.2 State -- 2.4.3 Action -- 2.4.4 Reward -- 2.4.5 Bandit

approaches for simulated learning -- 2.4.6 Extensions to online learning -- 2.5 Reinforcement learning -- 2.5.1 State -- 2.5.2 Action -- 2.5.3 Reward -- 2.5.4 Markov decision processes -- 2.5.5 Cumulated return -- 2.5.6 Policy -- 2.5.7 Value function -- 2.5.8 Partially observable MDP (POMDP) -- 2.5.9 Learning sequential surrogate models from episodic simulators -- 2.5.10 Prediction - learning a value function -- 2.5.11 Simulation-based search - decision trees -- 2.5.12 Monte Carlo tree search (MCTS) -- 2.5.13 Gaussian process regression with selection in MCTS for learning sequential surrogates (GP-MCTS) -- 2.6 Control - optimal policies and planning. 2.6.1 Optimal policy learning -- 2.7 Comparing predictions from multi-step and one-step methods with direct experience -- References -- 3 Health system preparedness - coordination and sharing of computation, models and data -- 3.1 Computation -- 3.1.1 A proposed infrastructure -- 3.1.2 Platform components -- 3.1.3 Performance results -- 3.1.4 Example: technical approach for competitions -- 3.1.5 Environment web service -- 3.1.6 Competition API -- 3.1.7 Example code -- 3.1.8 Related work -- 3.2 ML competitions for health system preparedness -- 3.3 Planning from learnt models -- 3.4 KDD Cup 2019 and other competitions -- 3.4.1 Evaluation framework -- 3.4.2 Submission and scoring -- 3.4.3 Other competitions -- 3.5 Collaboration from competition -- 3.6 Example: analysis of successful competition approaches -- 3.6.1 Conclusions on competitions for health system planning -- 3.6.2 Human-in-the-loop -- References -- 4 Applications of machine learning for image-guided microsurgery -- 4.1 Preoperative data collection -- 4.2 Preprocessing -- 4.2.1 Intensity histograms -- 4.2.2 Noise reduction -- 4.2.3 Contrast adjustment -- 4.2.4 Preprocessing review -- 4.3 Segmentation -- 4.3.1 Thresholding -- 4.3.2 Region-based thresholding -- 4.3.3 Edge-based thresholding -- 4.3.4 Post-processing -- 4.3.5 Validation -- 4.4 Registration -- 4.4.1 Image labeling -- 4.4.2 Feature identification -- 4.4.3 Feature matching -- 4.4.4 Transformation -- 4.5 Visualization -- 4.5.1 Real-time motion tracking -- 4.5.2 Overlaying -- 4.5.3 Image-guided microscopic surgery system -- 4.5.4 Augmented-reality-based microsurgical systems -- 4.6 Challenges -- 4.6.1 Infrastructure challenges -- 4.6.2 Safety challenges -- 4.6.3 Cost challenges -- 4.7 Chapter review -- References -- 5 Electrophysiology and consciousness: a review -- 5.1 Introduction -- 5.2.1 Central nervous system -- 5.2.2 ANS. 5.2.3 CNS-ANS connection in physiological mechanisms -- 5.2 Nervous system signals -- 5.3 Neurophysiological signal recording -- 5.3.1 Recording the electroencephalogram (EEG) -- 5.3.2 Recording the ECG -- 5.4 Applications of biopotentials in health and disease -- 5.4.1 Neurodegeneration -- 5.4.2 Anesthesia -- 5.4.3 Peri-operative stress -- 5.5 Analysis tools -- 5.5.1 ECG analysis -- 5.5.2 EEG analysis methods -- 5.5.3 Machine learning methods -- 5.6 Conclusion -- References -- 6 Brain networking and early diagnosis of Alzheimer's disease with machine learning -- 6.1 Background -- 6.1.1 A brief history of brain study -- 6.1.2 Modern understanding of the brain -- 6.2 Laboratory model of brain connectivity -- 6.3 Problem definition -- 6.4 Devices used in AD diagnosis -- 6.5 Data types -- 6.6 Data preprocessing of MRI data -- 6.6.1 Median filters -- 6.6.2 Physiological noise removal by means of deconvolution -- 6.6.3 Image fusion -- 6.7 Machine learning for early AD diagnosis -- 6.7.1 SVMs -- 6.7.2 Deep learning -- 6.7.3 SVM techniques -- 6.7.4 Deep learning techniques -- 6.8 Conclusion -- References -- 7 From classic machine learning to deep learning advances in atrial fibrillation detection -- 7.1 Physiology essentials -- 7.1.1 The healthy heart -- 7.1.2 Atrial fibrillation -- 7.2

Detection of AF -- 7.2.1 AF detection based on beat-to-beat irregularities -- 7.2.2 AF detection based on the ECG waveform morphology and hybrid methods -- 7.3 Conclusions -- References --
 8 Dictionary learning techniques for left ventricle (LV) analysis and fibrosis detection in cardiac magnetic resonance imaging (MRI) -- 8.1 Introduction -- 8.2 Basics of dictionary learning -- 8.2.1 Probabilistic methods -- 8.2.2 Clustering-based methods -- 8.2.3 Parametric training methods -- 8.3 DL in medical imaging - fibrosis detection in cardiac MRI -- 8.4 HCM and fibrosis.
 8.4.1 Myocardial fibrosis in HCM -- 8.5 Cardiac magnetic resonance imaging with LGE-MRI -- 8.6 The assessment of cardiac fibrosis detection in LGE-MRI: a brief state-of-the-art -- 8.7 The proposed method -- 8.7.1 Feature extraction -- 8.7.2 Clustering -- 8.7.3 DL-based classification: training stage -- 8.7.4 DL-based classification: testing stage -- 8.8 First experiments and results -- 8.8.1 Study population -- 8.8.2 Results -- 8.8.3 Evaluation -- 8.9 Qualification and quantification of myocardial fibrosis: a first proposal -- 8.10 Conclusion -- References --
 9 Enhancing physical performance with machine learning -- 9.1 Introduction -- 9.2 Physical performance and data science -- 9.2.1 Physical performance overview -- 9.2.2 The role of data in physical performance -- 9.2.3 Why ML? -- 9.3 Contextualise physical performance factors: ML perspectives -- 9.3.1 Training -- 9.3.2 Nutrition -- 9.3.3 Sleep and recovery -- 9.4 ML modelling for physical performance problems -- 9.4.1 Choosing ML models for the right physical performance tasks -- 9.4.2 Contributing ML features and methods -- 9.4.3 Challenges -- 9.5 Limitation -- 9.6 Conclusion -- References --
 10 Wearable electrochemical sensors and machine learning for real-time sweat analysis -- 10.1 Electrochemical sensors: the next generation of wearables -- 10.2 The mechanisms and content of sweat -- 10.3 Considerations for on-body sweat analysis -- 10.3.1 Sweat gland densities and sweat rates -- 10.3.2 Sweat collection techniques and challenges -- 10.4 Current trends in wearable electrochemical sweat sensors -- 10.4.1 Common features of wearable sweat sensors -- 10.4.2 Opportunities for ISFETs and machine learning in wearable sweat sensing -- 10.5 The ion-sensitive field-effect transistor -- 10.5.1 The fundamental theory of ISFETs -- 10.5.2 ISFETs in CMOS -- 10.5.3 ISFETs in CMOS for sweat sensing. 10.5.4 Existing ISFET-based wearable sweat sensors -- 10.6 Applications of machine learning in wearable electrochemical sensors -- 10.6.1 Existing research into ML for biosensors -- 10.6.2 Existing research into ML for ISFETs -- 10.6.3 Integration of analogue classifiers with ISFETs in CMOS -- 10.7 Summary and conclusions -- References --
 11 Last words -- 11.1 Introduction -- 11.2 A review of the state-of-the-art -- 11.3 Implementation and deployment -- 11.3.1 Traditional computing and the memory hierarchy -- 11.3.2 Graphics processing unit -- 11.3.3 Hardware accelerators -- 11.4 Regulatory landscape -- 11.4.1 A brief interlude -- 11.4.2 Software development life cycle -- 11.4.3 Risk management in medical software development -- 11.4.4 Challenges specific to ML -- 11.5 Conclusion -- References -- Index.

Sommario/riassunto

This edited book focuses on the applications of machine learning in the healthcare sector, both at the macro-level for guiding policy decisions, and at the granular level, showing how machine learning techniques can be applied to help individual patients.