Preface

Machine learning (ML) studies algorithms that can learn from data to gain knowledge from experience and to make decisions and predictions. Health Informatics (HI) studies the effective use of probabilistic information for decision making. Consequently, to bridge these two fields is of eminent importance for improving human health and well-being.

As a matter of fact, the discipline of health is increasingly turning into a data science and health systems worldwide are confronted with big data. This may be beneficial, as algorithms that improve through experience from large data sets can be of great help here, and automatic ML (aML) approaches show impressive results. Moreover, much health data are in arbitrarily high dimensions, where manual analysis is simply impossible, hence fully automatic approaches by taking the human-out-of-the-loop make great sense.

However, sometimes we are confronted with small data sets, or rare events, where aML approaches suffer from insufficient training samples. Here interactive ML (iML) may be of help, which can be defined as algorithms that can interact with agents and can optimize their learning behavior through these interactions, where the agents can also be human. Furthermore, such a human in the loop can be beneficial in solving computationally hard problems. Particularly a doctor-in-the-loop can be helpful, e.g., in subspace clustering, protein folding, or k-anonymization, where human expertise can help reduce an exponential search space through heuristic selection of samples. Therefore, what would otherwise remain an NP-hard problem, may decrease greatly in complexity by making use of human intelligence and human intuition involved in the ML pipeline.

Intelligence is the core topic of research and Demis Hassabis from Google DeepMind summarizes it precisely within his mission statement: “Solve intelligence. Then solve everything else.” A synergistic combination of methodologies and approaches from two areas attack the challenge of “solving intelligence” from two perspectives: Human Computer Interaction (HCI) and Knowledge Discovery and Data Mining (KDD).

Consequently, this HCI–KDD approach fosters the successful application of machine learning for health informatics, by encouraging an integrated approach, promoting a concerted cross-disciplinary effort of experts from various disciplines, including (1) data science, (2) algorithms, (3) network science, (4) topology, (5) time/entropy, (6) data visualization, and last but not least (7) privacy, data protection, safety and security.

Hence, the mission of the HCI–KDD expert network is to bring together professionals from diverse areas with various backgrounds and different views, but who share a common vision: “solving intelligence,” following the HCI–KDD motto “Science is to test crazy ideas – engineering is to bring those ideas into business.”

The HCI–KDD expert network organizes special sessions, the first took place in Graz (Austria), the second in Macau (China), the third in Maribor (Slovenia), the fourth in Regensburg (Germany), the fifth in Lisbon (Portugal), the sixth in Warsaw (Poland), the seventh in Banff (Canada), the eight in London (UK), the ninth in Salzburg (Austria), and the tenth is planned to take place in Reggio di Calabria (Italy) in summer 2017.

Volume 9605 of the *Lecture Notes in Computer Science* series is a state-of-the-art survey (SOTA) and an output of the international HCI–KDD expert network. The volume features 22 carefully selected and peer-reviewed chapters on hot topics in ML for HI. Each chapter discuss open problems and future challenges in order to stimulate further research and international progress in this field.

To acknowledge here all those who contributed to the efforts and stimulating discussions would be impossible. Many people contributed to the development of this volume, either directly or indirectly, and it would be simply impossible to list all of them, so let me thank my international, national, and local colleagues, my family and friends for all their nurturing and positive encouragement. Last but not least I thank the Springer management team and the Springer production team for their smooth support; a cordial thank you to all!

October 2016 Andreas Holzinger

http://www.springer.com/978-3-319-50477-3

Machine Learning for Health Informatics
State-of-the-Art and Future Challenges
Holzinger, A. (Ed.)
2016, XXII, 481 p. 98 illus., Softcover
ISBN: 978-3-319-50477-3