Databases, performance metrics and competitions as tools to strengthen research: common themes

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The advent of digital medical equipment and the shift towards wearable medical sensors (see for example [1], [2]) has allowed researchers to generate large internal collections of medical and physiological signals. These are a hugely valuable resource which can be used for better understanding of the underlying physiology, and also for the development and testing of novel automated signal processing algorithms to be used with wearable medical sensors (see for example [3–5]). These new algorithms can be used to assist physicians with decision support or to automatically raise alarms to summon help in critical situations. In either case the algorithm development requires large amounts of physiological data to verify the algorithm operation, and to demonstrate that the algorithm performance is maintained when it is used with new, previously unseen data which reflects how it would be used in practice. Unfortunately, but also inevitably, simply having lots of data available does not automatically solve all of our algorithm development problems. Indeed, it raises new challenges with regards to how we store, manage and access the data, and also as to how we make practical use of it when creating and testing new algorithms. There is now an essential need to link our increasing amounts of data with new performance testing methodologies to ensure that we can generate the maximum amount of information about real-world performance during the algorithm development process.

The objective of this mini-symposium will be to explore these new challenges, and to highlight new approaches for handling large amounts of data with appropriate performance testing methodologies. The session will begin by motivating databases as research tools and discussing current data management systems, which link to how data can be shared and made more readily available to researchers worldwide. The session will then investigate how and why the performance metrics that we choose to use can significantly alter the results and patterns that we find when testing biomedical signal processing algorithms. This will exemplify why our new data has to go hand-in-hand with new appropriate, standardized performance assessments. The final structured talk will then explore the use of data analysis competitions, which naturally combine standardised data and performance assessments, as a research tool. This will investigate the organisation of competitions: what works and what does not; what can be done differently; and how they work in geographically interested in the research area.

This is an intrinsically multi- and cross-disciplinary arena, and improvements in these research tools will have a huge impact on biomedical engineers. It is also a very wide area, and the session will aim to span it by drawing on particular examples in each of databases, performance metrics and competitions. An open floor at the end of the session will then allow attendees to highlight and draw attention to other examples, and to discuss the current data and tools that are available and how we can work together to create even better tools. In this introductory talk I will overview the issues, challenges and opportunities available. This will highlight the common themes and demonstrate how and why databases, performance databases and competitions interact and need to be tackled holistically. This will then set the stage for the discussions in the remainder of the mini-symposium.

REFERENCES


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