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EDITORIAL

Machine Learning and Medical Diagnosis.

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Recently, *Wilson et al. (2019)* reported the performance of a machine learning classifier to predict the diagnosis of Peritonsillar abscess *(PTA)* based on patient symptoms. PTA is the most common head and neck abscess; yet, its clinical presentation is imprecise and its management commonly involves needle aspiration or incision and drainage.

Clinicians decide whether to aspirate or to drain based on concerning signs and symptoms, such as sore throat, trismus, otalgia, unilateral palatal fullness, and uvular deviation. However, PTA diagnosis has reported poor accuracy, a specificity of 50% and a sensitivity of 78%.3 *(Wilson et al., 2019)*.

In order to improve or assist this diagnostic decision, *Wilson et al. (2019)* evaluated different Machine Learning *(ML)* approaches. As Deo *(2015)* states *"Machine learning is the scientific discipline that focuses on how computers learn from data. It arises at the intersection of statistics, which seeks to learn relationships from data, and computer science, with its emphasis on efficient computing algorithms"*.

ML appears as a promising option to analyze the large, complex and disparate data, often found within medicine. Thus, ML positions itself as the future for biomedical research, personalized medicine, computer-aided diagnosis, and advances in global health care *(Hendelman et al., 2018)*.

There is an increasing interest in ML in medicine, as well as a corresponding development in this area. In fact, as you search for the term *"machine learning"* in relation to medicine in PubMed, there are more than thirteen thousand references, with around two-hundred from 2010 up to almost four thousand in 2019. Consequently, it is likely that in the future more and more medical decisions will be made or at least assisted by ML or other artificial intelligence technologies.

Back to the research of *Wilson et al. (2019)* on PTA diagnosis, they trained and evaluated three ML algorithms: artificial neural network, random forest and logistic regression. They found that all three algorithms have superior accuracy than previous reports by clinicians. Artificial neural network showed the highest accuracy with 72.3%, a sensitivity of 86.5% and a specificity of 50%.

Despite the limitations of this study, mainly related to patient selection and representativeness, the ML algorithms relied this decision only on patient-reported symptoms, without any physical examination. *Wilson et al. (2019)* concluded that the use of this technology will be more helpful for clinicians who are less familiar with clinical findings of PTA.

The last conclusion will be a matter of discussion, not specifically around PTA diagnosis, but concerning the entire medical diagnosis, and how the future physicians *(and other health professionals)* will be trained. If an algorithm can provide better diagnosis on PTA than an average otolaryngologist, is it ethical to support a medical treatment decision based on the judgement of the algorithm or the clinician?

In case that we rely on algorithm-supported medical decisions, will it be ne-

cessary to train medical professionals in diagnosis or only to train them to make an adequate anamnesis in order to provide quality data for the algorithm?

Moreover, in case ML-based devices can collect patients' data by themselves *(including data that is not accessible or analyzable by humans)*, will it be necessary to train medical professionals in medical diagnosis at all?

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