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EDUCATION FOR WOMEN EMPOWERMENT: Big Data and Artificial Intelligence for Health

SHORT RESEARCH REPORT

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Short summary

Big data in healthcare refers to the vast amounts of information generated by healthcare systems, such as electronic health records (EHR), medical imaging, genomic sequencing, and clinical trials. This data can be used to develop more accurate and personalized patient healthcare strategies. For example, in oncology, big data can potentially transform cancer care by enabling the discovery of new treatments, improving diagnosis and prognosis, and predicting treatment outcomes. However, managing and analyzing such large datasets is a complex task that requires advanced computational and analytical tools. Artificial intelligence (AI) methods, specifically machine and deep learning are beneficial in this context, as they can process large volumes of data, identify patterns and relationships, and provide insights that can be used to improve patient outcomes. My research in the previous year focused on developing AI-based models for predicting immunotherapy (IO) treatment outcomes in lung cancer patients, precisely predicting a short-term response to the treatment and patients' survival time from the moment of diagnosis. Visual representation of my research is shown in Figure 1.

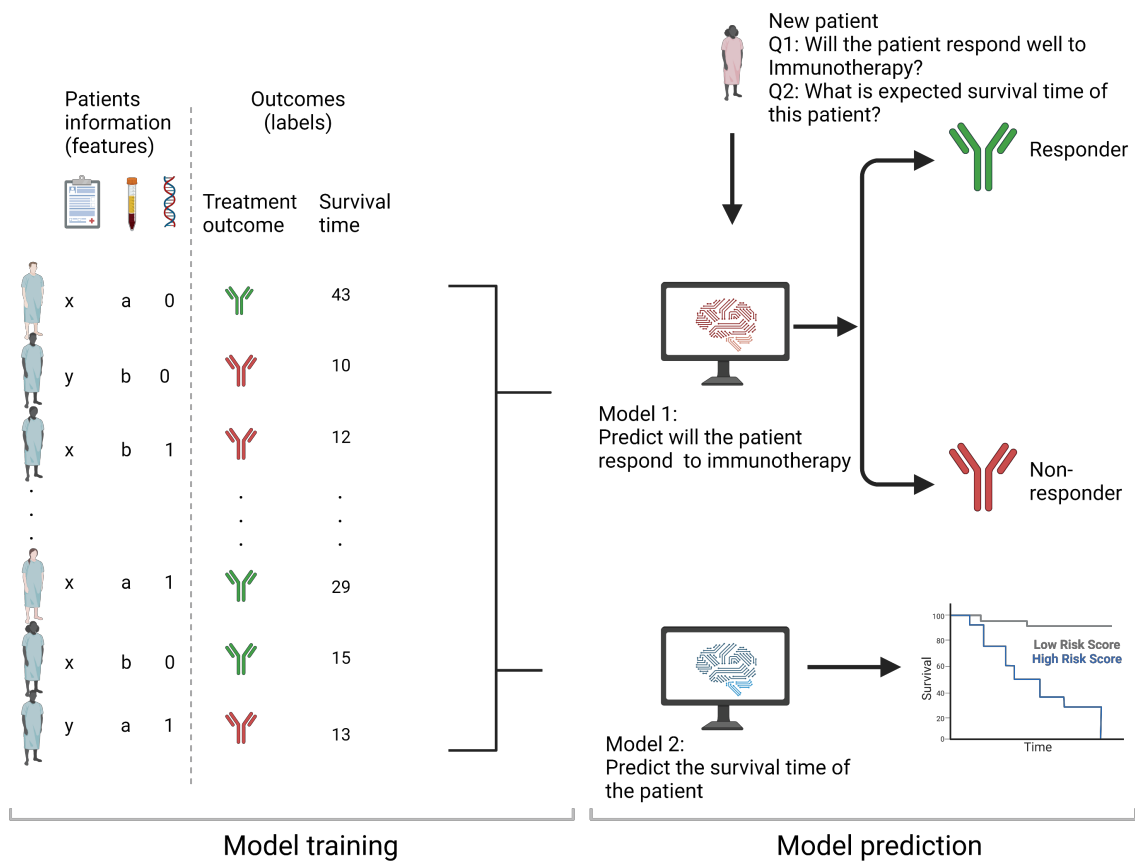


Figure 1: Visual abstract: Use of AI tools for predicting immunotherapy treatment response and survival time for lung cancer patients.

Main results

The main results include the following:

1. **May 2022 - January 2023** -Development and improvement of an explainable machine learning model that uses real-world (clinical and blood exams) data of patients with lung cancer to predict the response to IO treatment. Research is published January 2023, in *Frontiers in Oncology* (Prelaj et al., 2022).
2. **May 2022 - Ongoing** - Development of a workflow and models for explainable ML survival analysis to predict overall survival for patients diagnosed with lung cancer using clinical and genomics data. We are preparing the manuscript, which will be submitted to the ESMO Open at the end of May.
3. **October 2022 - Ongoing** - A systematic review of available literature using AI methods to predict response to IO treatment in diverse cancer patients using clinical, genomics, radiomics and pathomics data. The manuscript is ready and will be submitted to the *Annals of Oncology* by the end of April.
4. **May 2022 - Ongoing** - Active collaboration with medical oncologists from *Istituto Nazionale dei Tumori Milano (INT)*, and involvement in the I3LUNG project i3lung.eu.

Publications

1. Prelaj A, Galli EG, **Miskoivc V**, Pesenti M, Viscardi G, Pedica B, Mazzeo L, Bottiglieri A, Provenzano L, Spagnoletti A, Marinacci R, De Toma A, Proto C, Ferrara R, Brambilla M, Occhipinti M, Manglaviti S, Galli G, Signorelli D, Giani C, Beninato T, Pircher CC, Rametta A, Kosta S, Zanitti M, Di Mauro MR, Rinaldi A, Di Gregorio S, Antonia M, Garassino MC, de Braud FGM, Restelli M, Lo Russo G, Ganzinelli M, Trovò F and Pedrocchi ALG (2023) *Real-world data to build explainable trustworthy artificial intelligence models for prediction of immunotherapy efficacy in NSCLC patients*. Front. Oncol. 12:1078822. doi: 10.3389/fonc.2022.1078822 (Prelaj et al., 2022)
2. Prelaj A, **Miskovic V**, Michele Zanitti, Trovo' F, Genova C, Viscardi G, Rebuzzi SE, Mazzeo L, Provenzano L, Kosta S, Favali M, Castelo-Branco L, Dolezal J, Pearson A, Lo Russo G, Ganzinelli M, Ambrosini E, Turajlic S, Au L, Koopman M, Suzette D, Kather JN, Garassino MC, Pentheroudakis G, Spencer C, Pedrocchi ALG. Artificial Intelligence for the discovery of predictive biomarkers in immuno-oncology: a systematic review, **In preparation to be by the end of April to Annals of Oncology**
3. **Miskovic V**, Viscardi G, Provenzano L*, Dellacorte CM, Lo Russo G, Spagnoletti A, Ganzinelli M, Mazzeo L, Trovo' F, Pedrocchi ALG, Prelaj A *Explainable Machine learning survival analysis for predicting overall survival in NSCLC patient using liquid biopsy and clinical data*, **In preparation to be submitted in May 2023 to ESMO Open**.

Conferences and additional activities

1. Participation at AIOM22 conference (1-4 October 2022, Rome)
2. Participation at Lung Cancer – cocktail with science (20 October 2022, Milano)
3. Participation at Digital for clinics day (22 November 2022, Milano)
4. Participation at Open Robotics day at Politecnico di Milano
5. Supervision of master thesis (in progress), *ML and DL for predicting IO efficacy in NSCLC patients using radiomics data*, Student: Margherita Favali.
6. Supervision of master thesis (in progress), *Explainable ML for predicting IO efficacy in bladder cancer patients*, Student: Matteo Piceni.
7. Initiation of bi-weekly Journal club meeting where in a multidisciplinary team, we discussed the newest publications in the field

Future work

In the academic year 2023-2024, I intend to pursue my research in the same direction while also exploring other data types. Additionally, I plan to work

on integrating various data, which is a new area of focus in cancer research. I will also incorporate new data from retrospective and prospective patients. My research will be conducted at Politecnico di Milano, DEIB department, in collaboration with Prof. Pedrocchi. From April 2023, I will take on a new role as a Professional Collaborator at INT.

References

- A. Prelaj, E. G. Galli, V. Miskovic, M. Pesenti, G. Viscardi, B. Pedica, L. Mazzeo, A. Bottiglieri, L. Provenzano, A. Spagnoletti, et al. Real-world data to build explainable trustworthy artificial intelligence models for prediction of immunotherapy efficacy in nscl patients. *Frontiers in Oncology*, 12, 2022.