Artificial Intelligence real-world applications in pediatric neuro-oncology: The AICCELERATE project

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Background

Artificial Intelligence (AI) holds the promise to transform medicine during diagnosis, management and therapy of diseases. The AICCELERATE project will introduce an operational approach to develop AI-enabled digital solutions to improve medical processes by creating a digital twin. In our study, we performed the first pilot application of the AICCELERATE project at Bambino Gesù Children’s Hospital in Rome (OPBG). The aim of our study is to design a supervised machine learning (ML) model to predict time to surgery and time to diagnosis based on inputs on time from admission to first consultation and imaging in newly diagnosed pediatric patients.

Material and methods

We included pediatric patients with new diagnoses of brain tumors, treated in OPBG from December 2017 to December 2022. We collected from EHR the following data: age and sex, start and end date of the first admission, department of hospitalization, consultations and radiological imaging date, diagnosis, and surgery date.

Results

We included 48 patients with a pediatric brain tumor, with a mean age of 8.6 years. We used a multiple linear regression model.

Our analysis showed that delayed consulting and imaging led to a delayed diagnosis, with the consulting presenting a higher importance than the imaging.

This result was validated by the model’s estimated regressors coefficients, with the consulting factor being assigned a larger weight βC=1.81 than the imaging factor βI=0.33. Similarly, we observed that delayed consulting and imaging led to a delayed surgery, estimating a higher coefficient for the consulting βC=0.71 than the one estimated for the imaging βI=0.06.

While the ML model achieved a reasonable performance in both frameworks, the time to surgery was predicted with a lower MAE of 4.45±0.87 compared to the diagnosis MAE of 6.74±0.95.

Conclusion

This preliminary study conducted in a small number of patients, suggests that decreasing time to consultation can shorten time to surgery in children with brain cancer. As the AICCELERATE is ongoing, more accurate models will be developed and will help to better understand how to optimize the journey of children with brain cancer.