An Approach to Explainable AI for Digital Pathology

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The Blackbox

- Many medical diagnostics are currently based on imaging technologies.
- The development of machine learning (ML) image processing has increased the research on diagnostic support aids based on these technologies.
- Medical image processing will experiment a breakthrough
- when this type of tools become widely available and accepted by the medical community.
- A problem is related to the lack of understandability of their diagnostic suggestions due to their Blackbox nature

Approaches to Understandability

- Understanding the internal layer results and their contribution to the system global outputs.
- Modifying the system architecture to make the internal layer results more meaningful.
- Using a “model agnostic” component that provides complementary explanations .

Digital Pathology (DP)

DP is a specially difficult case due to:

- Digital pathology is not just a transformation of the classical microscopic analysis of histological slides to digital visualization, it is an innovation that is changing medical workflows greatly;
- Much information is hidden in high dimensional spaces,not easily accessible at first sight, thus we need AI systems to help the pathologists in accessing and interpreting his data.
- The new workflows should provide ways in which pathologists can easily use their existing knowledge

TECHNOLOGY BENCHMARKING

- Good results achieved for cancer detection with an accuracy similar to that achieved by an average pathologist (e.g. breast cancer Chamelyon 16 ROC AUC 92% error rate 0.52%)
- It is necessary to make the results transparent and explainable on demand (e.g. areas in blue are considered a type X tumor because characteristics A and B are present)

Conclusions

Designing, implementing,testing and evaluating by professionals and students a small scale understandable digital pathology diagnostic aid could represent a major scientific and technological break-through in the field of software and integration for medical imaging.