

Title: Development of a system in order to predict tumor metastasis and recurrence and to improve diagnostics and treatment of cancer patients

Problem

One of the most popular disease in our modern society is cancer. Many people die because of the consequences of tumors, evolving in their bodies and capturing nearly all of their good, healthy cells. The cause of tumors is the mutation of cells into 'bad' cells which clone themselves uncontrolled and irregularly. This makes it very hard to diagnose and prevent new tumors. Sometimes, even experts cannot diagnose precisely, e.g. in case of malignant tumors which are not delimited in the MRI pictures but tend to proliferate in an unknown degree. Another problem is the point of time the diagnosis is made. Since many people who do not suffer from any chronic disease tend to go to the doctor infrequently, the tumor is detected too late. What is more, most biopsies take up to multiple days which is a long time.

Goal

Given the above explained problems, the goals are to improve diagnostic and treatment of tumor patients by developing a model which predicts tumor metastasis and recurrence. Moreover, the system shall help doctors to quickly identify a patient whose cells are mutating so that he can intervene and treat the patient at the right time. Furthermore, the information process shall be improved by setting up a mobile and web application which keeps the patients up to date and serves as a communication base for healthcare providers.

Methodology

First, to get an overall business understanding, the key users (patients and treating doctors) are interviewed to find out the scope of the mobile and web application. At this stage, design thinking methods are used. Second, CRISP-DM (CRoss-Industry Standard Process for Data Mining) is used for data analysis process. Beside business understanding, it includes data understanding, data preparation, modelling, evaluation and deployment. Third, pattern recognition is implemented in order to find out patterns in the mutations of tumor cells. The pattern recognition includes feature extraction (e.g. tumor cell vs. healthy cell values) and classification. When characterizing attributes common to all patterns belonging to a class, genetic algorithms are used. Lastly, to develop the mobile application, the framework IONIC is implemented since it scales both web and mobile applications.

Benefits/Contribution

By reason of the adopted methodologies, there are many benefits for all users. To be more precise, patients do not have to suffer from the treatment of cytostatics too long since the algorithm predicts the exact location of the tumor and only a local treatment is needed. Besides, patients do not have to wait too long for the treatment outcome since they are informed by the mobile application.

Relevance

To conclude, this master thesis is very relevant in both scientific and economic contexts. Regarding the scientific context, diagnostic and treatment of cancer patients are improved. Human errors, such as unprecise detection of tumors in MRI images are eliminated. Moreover, patients feel more comfortable since they can stay longer at home.

Relating to the economic context, the developed system reduces the costs of chemotherapies and treatments since they can be personalized for each patient. After that, doctors are unburdened and can treat more patients at the same time. Besides, there are more free beds in a hospital.