Prostate Cancer AI Decision Support

I. Introduction

The prostate secretes fluid that nourishes and protects sperm. Also known as prostatic carcinoma, prostate cancer, Prostate cancer begins when cells in the prostate gland start to grow out of control. **How can we detect it as soon as possible ?** Because as we know, the sooner we detect a cancer, the more chance we have of getting better.

II. Problem presentation and related works

A. Problem presentation

Prostate cancer is marked by an uncontrolled (malignant) growth of cells in the prostate gland, which can cause infertility. Prostate cancer can be slow-growing, such that many men die of other diseases before the prostate cancer causes significant problems. However, many prostate cancers are more aggressive and can spread outside the confines of the prostate gland, which can be deadly. Also, in most cases, prostate cancer causes no symptoms. By the time you realize it, it's more advanced.

B. Motivation

According to [2], deaths increased by 2.0-fold from 191,687 in 1990 to 380,916 in 2016. The global age-standardized incidence rate (ASIR) increased from 17.75 in 1990 to 22.12 in 2016, changing 24.62.Prostate cancer is the second most common malignancy in males and the sixth leading cause of cancer mortality in men with a relatively higher death rate in men of African descent according to [1]. However, the prostate cancer survival rate is greatly improved with early detection and personalized treatment.

C. Related works

Several works have been undertaken in this field. Bioligical approaches have been described in [3]. For example ,the European Randomized Study of Screening for Prostate Cancer was established in 1994 when 162,388 men aged 55–69 were randomized to either receive prostate-specific anti-gen (PSA)-based screening or not. Of 72,891 patients assigned to PSA screen-ing, 355 (0.49%) died from prostate cancer,compared with 545 (0.61%) out of 89,352patients in the control group. The rate ratio forprostate cancer mortality was 0.79. Today, the histopathological assessment of biopsy tissue is the mainstay of diagnosing prostate cancer, which includes core needle biopsy (CNB) and, if warranted, surgical resection. However, these solutions remain out of reach in our country.

D. Proposed solution

To overcome this problem, we proposed an AI Assistant named **PCDet**, that will allow the doctor to quickly identify patients with cancer

III. Methodology

Because of the lack of Cameroonian data on the prostate, we adopt a data driven approach. To be able to build a reliable model allowing to determine the presence or not of a prostate cancer, we carried out several stages:

1) The search of datasets.
2) The creation and validation of a model.
3) The development of the application that the doctor will interact with

A. The research of datasets

After a few days of searching through the web, we saw several datasets each with different features with describe a prostate tumor. We chose the one that had the most features in common with the others. This gave us a small sample size. Their features are :

- radius
- texture
- perimeter
- area
- smoothness
- compactness
- symmetry
- fractal_dimension

We will use this feature to predict if we are a benign or malign form.

B. Creation and validation of a model.

We have used the accuracy to train and validate your models. We have 03 approaches:

- **Random Forest Classifier** (class_weight="balanced", n_estimators=1000, other parameters have their default value). It fits a number of decision tree classifiers on various sub-samples of the dataset and uses averaging to improve the predictive accuracy and control over-fitting. It scored **0.801**
- **KNN Classifier** it implements the k-nearest neighbors vote. we made k vary from 1 to 20. And the best score was **0.83**
- **Logistic Regression** . It implements regularized logistic regression vote. We obtained the best score which is **0.867** with k=3

C. Development of the application

We have developed a web application with Flask to allow the doctor to interact with our models. It consists of a form that the doctor will fill out. Then, according to the information he will have given, we will say if we have a

malignant or benign form. The application is accessible via https://pcdet.herokuapp.com/

IV. Conclusion and Future works

The results obtained from the model is a little bit satisfying but not enough to be used in real world. Also, we need to collect more representative data (coming from Cameroon) and use metrics that penalize false negatives more.

References

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