WWW.CHECKIBS.COM: AN ONLINE WEB APPLICATION FOR PSYCHOSOMATIC SYMPTOMS BASED EVALUATION OF IRRITABLE BOWEL SYNDROME USING MACHINE LEARNING METHODS

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Introduction

The prevalence of psychosomatic symptoms such as fatigue, depression, anxiety and sleep deprivation is frequently reported in patients suffering from irritable bowel syndrome (IBS) [1-3]. These psychosomatic co-morbidities in IBS are now increasingly described as a consequence of dysfunction in bi-directional communications within so-called brain-gut axis [4]. Based on this link, suggestions have been made to include psychosomatic evaluation into traditional IBS diagnosis to improve its accuracy [5-6]. However, no suitable evaluation system has been developed so far to test psychosomatic status of patients with IBS, which can potentially provide a rapid and effective decision support system in clinical IBS diagnosis.

Aims & Methods

We aim to develop a new psychosomatic evaluation system for IBS by using machine learning (ML) based classification techniques and to deploy it online through an open access web application for global gastroenterology community.
A dataset comprising of three psychosomatic patient questionnaires i.e. hospital anxiety and depression scale (HADS), Bergen insomnia scale (BIS) and Chalder fatigue scale (FSS) was collected from 84 participants enrolled in Bergen brain-gut study [7]. This included 49 patients with IBS and 35 healthy controls (HC) . HADS questionnaire was further split into anxiety (ANX) and depression (DEP) questionnaires.
After necessary pre-processing i.e. cleaning, imputation and stratified sampling, the dataset was split into training (60%), validation (20%) and test sets (20%). Four patient questionnaires were arranged in all possible combinations resulting in fifteen groups and each question was regarded as an independent symptom feature. The patient demographics i.e. age and gender were also added to each group.
A customised sequential feature selection technique was applied on train set to select an array of feature vectors from questionnaire group. These feature vectors were used to train Logistic regression models and the best model in each g was selected on basis of its performance on the validation set. The overall best performing model was selected on basis of

Results

The overall best performing model achieved using the above described ML workflow, when applied on the test set, accurately classified all (10) patients with IBS and 6 out of 7 HC, as shown in Table 1.

Table 1: A confusion matrix achieved from applying best performing model on the test set

	HC	IBS
HC	6	1
IBS	0	10

This led to accuracy and balanced accuracy scores of 94.1% and 92.9%, respectively. The recall and precision scores were 100% and 90.9%, respectively. The model used a combination of three questions from ANX and five questions from FSS questionnaires and patient gender as its input.

Conclusion

The high classification accuracy of psychosomatic model on unseen data shows effectiveness of psychosomatic evaluation in IBS diagnosis.
The feature vector associated with final psychosomatic model suggests prevalence of anxiety and fatigue in patients with IBS.
Our ML based psychosomatic model is freely available at www.checkibs.com for testing and use.

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Disclosure

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