A Recommender System for Sweaty Sock Syndrome

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Abstract. Dermatosis disease is also known as Sweaty Sock Syndrome (SSS). Most of the children and young teenagers are affected by SSS. It damages the skin of the children and the young teenagers with red soles on the feet. A new methodology is used to find the stages of Sweaty Sock Syndrome using Multilayer perceptron (MLP) and EM clustering technique. The symptoms and stages of SSS are classified by using predictive modeling. In Multilayer perceptron technique, data objects are classified based on the stages of SSS and find out their efficiency and accuracy. EM Clustering is an unsupervised technique, which is characterized the objects based on the weights. Supervised learning identifies the various symptoms of SSS disease. It categorizes the data such as initial, non severe and severe by using learning by example. Learning by observation method categorizes the data into different clusters, which is grouped as initial, non severe and severe. It helps to know the various stages of dermatosis by using predictive and descriptive modeling. This prediction helps to recommend the patients those who are affected by SSS and provide suggestion to the patients.

Keywords: Multilayer Perceptron (MLP), EM Clustering, Sweaty Sock Syndrome (SSS), Dermatosis.

1 Introduction

The skin is an indicator of a person's health and beauty. The outer pollutants and inner toxins affects the human skin such as scars, stretch marks, hyper pigmentation, under-eye dark circles, redness, dryness, scaly skin, itchy rash, wrinkles, cracked skin etc, so that the skin needs a special care and provides a comprehensive solutions to remain staying youthful, vibrant and clear. This study finds the knowledge by using supervised and unsupervised learning algorithms. To find the efficiency of artificial neural network technique by using the Root mean square error and Mean absolute error. The SSS is a painful dermatitis, which affects the children aged from 5 to 16. It makes the socky skin becomes scaly and cracked. The supervised learning process identifies the patients' objects using Multilayer perceptron, which categorizes as Initial, Severe and Non-Severe [8.9]. The predictive modeling is used to differentiate the case which falls into three categories such as Initial, Severe and Non- Severe stages. Multilayer perception has been employed to predict the knowledge about the disease. Symptoms stage is a class variable used for classification. In descriptive modeling the cluster instances are categorized based on the symptoms of the SSS .Each cluster reveals the identity of the symptoms of SSS [10, 11].

2   Motivation

2.1   Sweaty Sock Syndrome

Sweaty Sock Syndrome causes the plantar skin to appear glazed, fissured and infect the children's hand with similar signs. This disease affects the boys, their age lies between four and eight. The infection of the feet becomes prominent in the toes and sole resulting in shiny and glazed look. It affects the skin becomes flaky and fissures are developed. [3]. Sweaty Sock Syndrome symptoms seen in 'atopic' children, such as atopic eczema, asthma, or hay fever. It creates the irritation, which is immense when the movement of the foot up and down is sweaty. The foot becomes wet due to the usage of synthetic shoes [4].The following symptoms are found such as scars, stretch Marks, under eyed circle, acne, wrinkles, dryness, redness, cracking, and scaling of weight-bearing surface of foot.

2.2   Expectation Maximization (EM) Clustering

This algorithm used to estimate the parameters by employing iterative approach. It classifies the objects into different clusters based on the mean. It assigns each objects into different clusters according to a weight, which represents the probability of membership [1].

2.3   Multi-layer Perceptron

The Multilayer Perceptron is one of the techniques for classification task. It is a network of simple neurons called perceptrons. It implies a single output from various valued inputs forming a combination to input weights and then releasing it through non linear activities [13].

3   SSS Approach

In Phase I, the patient dataset has been collected from dermatologists. The patient dataset contains the symptoms such as redbloodshotEyes, wrinkles, scars, itchrash, crackedheel, dryness and hayfever. The information has been analyzed and used for the experiment. In this dataset, demographic information is gathered from the patients. The result dataset contains the demographic and patient symptoms information is used for analysis.

   In Phase II and III, Predictive and Descriptive mining methods are used to find the impact of disease in the urban area. The methods are EM clustering and Multi Layer Perceptron respectively. Each cluster reveals the stages of the SSS disease and designates the cluster as 1) Initial 2) Non -Sever 3) Severe. The Multi Layer Preceptron is assigned to SSS stages of the patients. The six sigmoid nodes are used as inputs, the weights are assigned to each node, and six output layers are classified based on SSS stages. According to the stages based classification, the ten sigmoid nodes are used as input and three output layers are classified based on the stages of SSS. In Phase IV, the association between symptoms and SSS stage are analyzed using interesting measures.
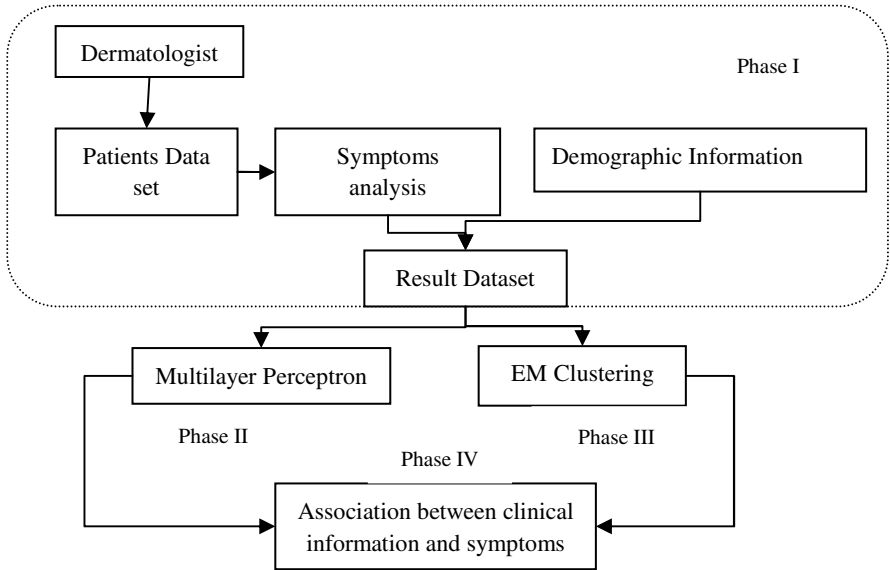
Fig. 1. Sweaty Sock Syndrome Approach

4   Results and Discussions

The dataset containing 300 patients' objects are used to find the association between SSS symptoms and their stages of the patient. The physician's interpretation of clinical data

Table 1. Cluster assignments and Sweaty Sock Syndrome Symptoms

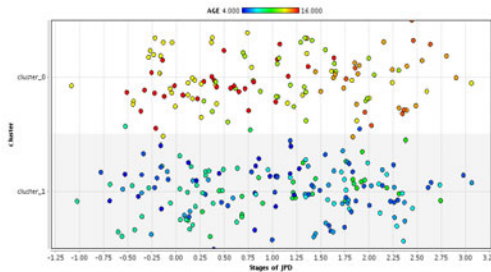| Cluster			Symptoms
C 0	**C 1**	**C2**	**Stages**
80	0	32	Initial
11	0	59	Non- Severe
0	0	118	Severe

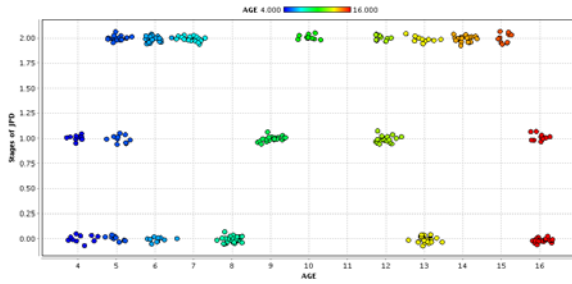**Fig. 2.** Clustering of Sweaty Sock Syndrome disease

Fig. 3. Classifications of Sweaty Sock Syndrome stages with age

Table 2. Confusion Matrix for Sweaty Sock Syndrome Stages

Experiment	Actual category	Predicted Category		
		Initial	Non severe	Severe
Training Data	Initial	11	0	0
	Non Severe	0	7	0
	Severe	0	0	12
Validation Data	Initial	99	0	0
	Non Severe	0	63	0
	Severe	0	0	108

and clinical images are used in the medical dataset. The knowledge is occurred from mining technique, which is used to find the interesting patterns from the dataset.

Table 1 show that various clusters and corresponding stages are categorized. It reveals that the various stages of the SSS. The patient affected by SSS as initial stage is clustered in C0. C1 cluster contains those who are affected by the SSS as Non-Severe. C2 cluster contains those who are affected by the SSS as Severe. It divulges that there is a misclassification occurs in descriptive modeling.

Table 2 show that the classification of data objects existed in the patient's dataset. In training model, eleven patient objects are categorized as Initial stage, seven objects are categorized as Non-Severe and twelve objects are categorized as Severe. In validation model, 99 patient objects are categorized as Initial stage, 63 objects

Table 3. Error rate in SSS dataset

Types of Error	Training set (%)	Testing set (%)	Cross-validation (%)	Test Split (%)
Mean Absolute Error	0.009	0.0055	0.0047	0.0025
Root Mean Squared Error	0.0115	0.0076	0.0062	0.0033
Relative Absolute Error	2.0462	1.2555	1.0848	0.5852
Root Relative Squared Error	2.4468	1.6123	1.3263	0.7002

are categorized as Non-Severe and 108 objects are categorized as Severe. This divulges that there is no misclassification occurs in this modeling. Fig 2 and Fig 3 reveals the classification of Sweaty Sock Syndrome stages.

Table 3 shows that the error rate of the dataset in predictive modeling. It reveals that the various types of errors are measured, which is Mean Absolute Error, Root Mean Square Error, Relative Absolute Error and Root Relative Square Error. The Root Mean Squared Error rate value is low relatively the Root Relative Squared Error value is low. It indicates that the classification model is good. So that it is good enough to classify the SSS stages.

The lift and gain chart is used for calculating the efficiency rate for SSS dataset using MLP. Lift and gain values are used to find the target value based on the order of purity. (Stages of SSS=Initial, severe and nonsevere). The training and validation test yields same percentage of objects. It reveals that shows the accuracy of the model.

The lift shows the value of 2.7 and meets the percent of population as 38 percent. A gain chart reveals that there is an improvement in the model. The figure 4a, 4b and 4c shows the average gain is nearly 2.0001. Only there is a slight variation can occur between training and test data.
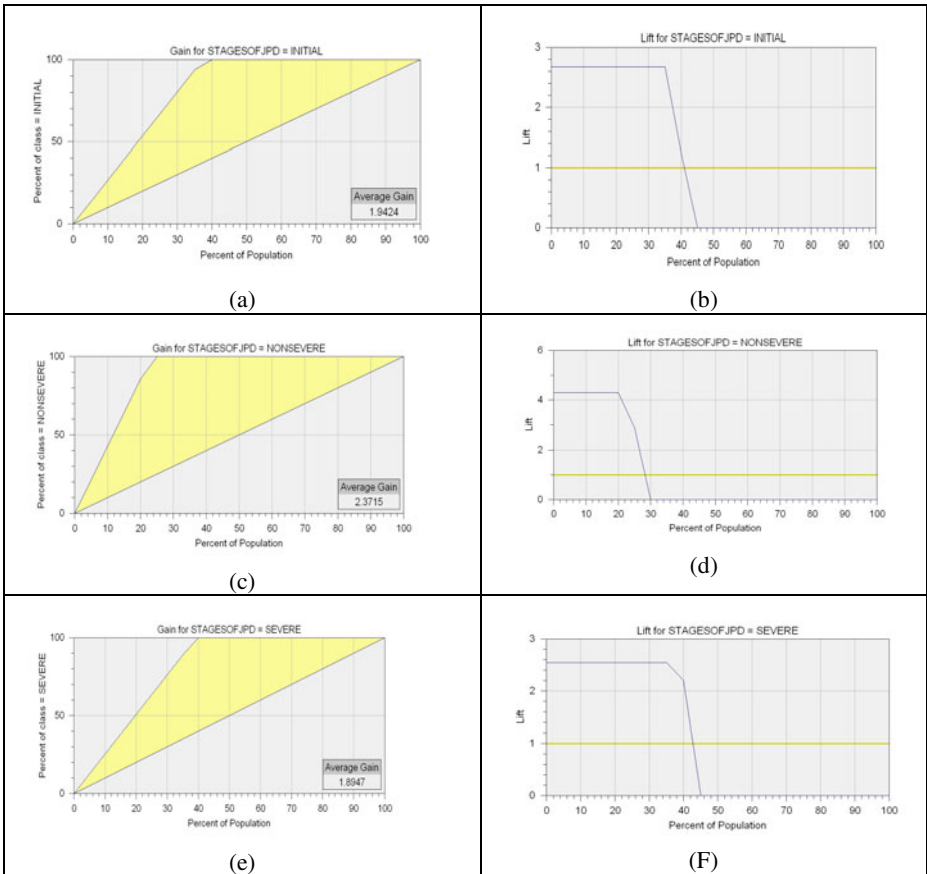

Fig. 4. Lift and Gain chart for SSS

The accuracy measure reveals that the dataset doesn't contain any erroneous data. The sensitivity is the proportion of the patients who are affected by the SSS analysis, which shows that the classification is accurate. The specificity is the proportion of the patients who are not affected by the SSS. Sensitivity and Specificity would be both 1. The sensitivity value shows that the most of them are affected by Initial stage, Non-Severe stage. Some of them are affected in Non-Severe stage in SSS. The prediction can also be viewed as a mapping or function $Y = f(X)$ where X is the input and the output Y is a Nominal value [12]. The mapping or function model shows the association between X and Y. The lift and cosine measure are used to find the correlation. The correlated value of X and Y are 1.789, which is positively correlated, meaning that the X and Y are associated with each other. The cosine value of X and Y are 0.612, meaning that there is a positive correlation between X and Y. Table 4 provides a recommendation for the patients based on symptoms of SSS.

Table 4. Recommendation for SSS

SSS stages	Recommendation
Initial Stage	Reduce friction, Lubricate the dry skin
Non -Sever Stage	Reduce friction, Lubricate the dry skin, Skin cleansers
Sever Stage	Skin cleansers, Have a rest day, Topical steroids, Moisturizer ingredients

5   Conclusion

In this Paper, two popular mining methods are used to predict the patient information. EM clustering technique categorizes the patients' information into three clusters such as cluster 0, 1 and Cluster 2.The Non-Severe stage falls into both clusters 0 and 2. In this categorization, there is a misclassification in the data and reveals that the patient Non–Severe symptoms are related with initial and severe stages. In Multilayer perceptron technique, the three stages are identified as Initial, Severe and Non-Severe stages. It divulges that the there is a perfect classification. Children and teenagers with SSS and atopic dermatitis are excluded. Standard treatment is advised for the children and teenagers. It comprises general advice on foot protection and liberal application of emollients for all the children, and topical corticosteroids for acute flare-ups of erythematous and pruritic feet for short duration to some children. The correlation analysis unveils that the symptoms and stages have strong association. The association between each entity is identified by using classification.

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