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INTEGRATING MACHINE LEARNING AND CLINICAL DATA FOR ACCURATE FOOT PAIN DIAGNOSIS AND PREDICTION

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Abstract
Foot pain and problems directly affect the quality of human life. The functionality of the foot and associated functions are also affected. The foot problems can be caused due to multiple factors. The use of predictive algorithms utilizing the electronic health records of the patients and data acquired from other sources is helping the healthcare industry to develop tools that are very helpful in diagnosis and prognosis. Professional physiotherapists have been consulted for restructuring of Foot Health Status Questionnaire (FHSQ). Machine learning model and foot disorder predictive algorithm based on the real-world data collected from the foot disorder patients has been developed that is able to accurately diagnose the foot problem of patient. The machine learning methods GaussianNB, Random Forest, XGBoost, Logistic Regression, KNN, Decision Tree and AdaBoost have been applied to predict foot disorders. The statistical analysis has been performed for finding the association between foot disorders and other variables. The results of the study have provided useful results about association of variables and the frequency charts and tables provide the useful description of general trends of the society towards the foot functionality and problems as well. Strong association is found among various factors and foot pain.

INTRODUCTION

The human foot is one of the most important structures of the body, carrying the entire weight and enabling balance, mobility, and daily movement. It provides the necessary foundation for standing, walking, and running, and therefore plays a vital role in maintaining independence and quality of life [1]. When foot health is compromised, the overall well-being of an individual declines, as mobility becomes restricted and daily tasks become difficult to perform. Chronic pain, disability, or misdiagnosis of foot-related problems not only reduce the quality of life but may also lead to incorrect or delayed treatment [2]. Unfortunately, diagnostic approaches for foot diseases often remain weak and fragmented in many healthcare systems, which leads to poor management, long-term complications, and in certain cases, permanent disability [3]. The diagnosis of foot problems is a highly complex process due to multiple overlapping symptoms, comorbidities, and variations in individual conditions. Patients often find it difficult to communicate their symptoms clearly, and the similarity of different foot conditions further complicates diagnosis. The prevalence and causes of foot disorders also differ across geographical regions and populations. For example, the secondary causes of foot problems in Southeast Asia may not be the same as those in Europe, and even within the same geographical location, populations such as students and nursing staff may present with different patterns of foot pain and dysfunction [4]. Such variations emphasize the need for approaches that go beyond traditional diagnostic methods and take into account occupational, environmental, and lifestyle-related factors.

Factors influencing foot health are diverse and include employment type, standing hours per day, body weight, body mass index (BMI), footwear type, and even long-term postural habits [5]. Foot disorders are strongly linked to quality of life, as they impact social, occupational, and psychological well-being. For example, university students in Spain showed that poor foot health directly affected their daily functioning and self-reported well-being [4]. Similarly, studies among nurses in Japan revealed that prolonged standing, improper footwear, and increased BMI were significantly associated with foot and ankle pain [6]. A large survey in the United Kingdom further highlighted that lifestyle characteristics, occupational demands, and health factors all contribute to the prevalence of foot pain and dysfunction [8]. These findings confirm that foot health cannot be studied in isolation; it must be assessed within the broader socio-physiological and occupational context of individuals. In recent years, the rapid development of computational tools, particularly machine learning (ML) and artificial intelligence (AI), has transformed healthcare. Machine learning provides powerful methods to analyze large datasets, discover hidden associations, and predict medical outcomes that traditional diagnostic techniques cannot easily identify [3]. In the field of foot health, ML has been applied to predict disorders, classify foot types, and even assist in treatment planning. Algorithms such as Random Forest, XGBoost, Logistic Regression, KNN, GaussianNB, and Decision Trees have shown promising results in predicting patient conditions based on clinical and demographic data [14 - 16]. These tools are particularly valuable for handling complex, multidimensional data such as electronic health records, patient questionnaires, and sensor-based foot pressure measurements [5][10].

Several studies demonstrate the effectiveness of applying ML techniques to foot health problems. For instance, deep learning models using heterogeneous pressure data have successfully classified foot types with improved accuracy [5]. Plantar fasciitis, one of the most common causes of foot pain in adults, has been detected using deep learning methods combined with thermal imaging, which provided a smart and automated diagnostic framework [7]. Sensor-enabled footwear integrated with one-dimensional convolutional neural networks (1D-CNN) has also been used to distinguish foot types and detect abnormalities [10]. Similarly, ML has been applied to predict the need for orthotics among stroke patients, enabling early intervention and better rehabilitation outcomes [9]. These applications illustrate how AI and ML are expanding the possibilities of diagnosis, prevention, and management of foot problems beyond conventional medical practices. The importance of lifestyle factors, footwear selection, and posture has also been widely recognized in research. Improper footwear, for example, not only leads to discomfort but can also have long-term impacts on lower limb posture, gait, and musculoskeletal health [11]. An observational study among physiotherapy students in Karachi reported a high frequency of foot pain associated with footwear habits, confirming the role of everyday lifestyle in determining foot health [12]. Prolonged standing, as commonly observed in occupations such as nursing and teaching, further increases health risks associated with musculoskeletal disorders, reinforcing the need for preventive and diagnostic strategies tailored to specific occupational groups [13].

Given these complexities, there is a pressing need to combine clinical expertise with computational models to improve the diagnosis and prediction of foot disorders. This study integrates real-world clinical data with machine learning techniques to build predictive algorithms capable of diagnosing foot pain with greater accuracy. The Foot Health Status Questionnaire (FHSQ) was restructured with the guidance of physiotherapists and applied alongside statistical analysis to examine the associations between foot disorders and variables such as occupation, BMI, footwear, and standing hours. By applying a variety of machine learning models GaussianNB, Random Forest, XGBoost, Logistic Regression, KNN, Decision Tree, and AdaBoost this research aims to generate predictive insights that can assist in clinical decision-making and improve patient outcomes. The findings of this study not only advance the scientific understanding of foot health but also demonstrate the broader potential of machine learning in healthcare. As complex disorders continue to challenge traditional diagnostic frameworks, the integration of computational tools provides clinicians with powerful, data-driven methods for early detection, personalized treatment, and preventive care [17 - 18]. In doing so, it aligns with the growing movement towards precision medicine and supports the development of innovative healthcare solutions tailored to the unique needs of diverse populations.

2. Data Collection Methodology

- Numeric Pain Rating Scale (NPRS 11) is generally used to study the intensity of pain [13]. And the numeric pain scale rating is categorized as No Pain, Mild, Moderate, and Severe Pain as shown in the Figure 1 [13].

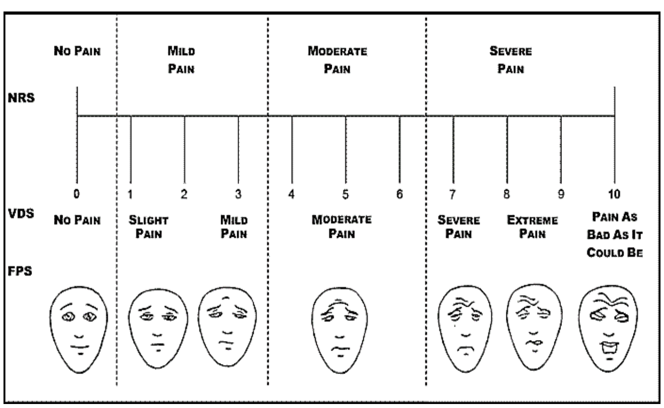

Figure 1: Numeric Rating Scale Categorization.

2.1. Population Sample Size and Nature

The first and foremost thing was the calculation of the sample size. Various detailed methods are available for the calculation of the sample size. In this study the Epitool calculator was used to determine the sample size. Epitools contains the epidemiological calculators, diagnostic tests, and the tools available for the epidemiologists and other professionals working on the prevalence of the diseases. The desired estimated precision and the confidence level was specified. The proposed sample size came to be 324.

2.2. Questionnaire

- The questionnaire contains the demographics related questions that are based on age gender, and education.
- BMI of the participants was calculated using the height and weight.
- The questionnaire contains the simplified foot behavior questions that include foot problem, foot problem region and number of standing hours.
- The questions related to the difficulty in the walking, performing tasks, and more importantly the type of footwear that the participants normally wear was also asked.

3. Statistical Analysis

The statistical analysis of the data was done using IBM SPSS. The main types of the statistical analysis done was the frequency distribution study and chi-square test for finding the association between the variables. Among the population studied, the highest number and the percentage belonged to the young people having the age of 25-30 years. 113 individuals (34%) percent of the population belonged to the age group of 25-30 years. Figure 2 shows the distribution of population according to the age group.

The occupation wise distribution of the population has been presented in Figure 3. It can be seen that the highest number of individuals belonged to the category of housewives. Out of the total population of 324 individuals, 119 were housewives.

Similarly, the education wise distribution of the population has been presented in Figure 4, from educational perspective, the majority of the population was graduate.

The trend of the foot problems prevalence has been shown in the form of percentages in TABLE 1.

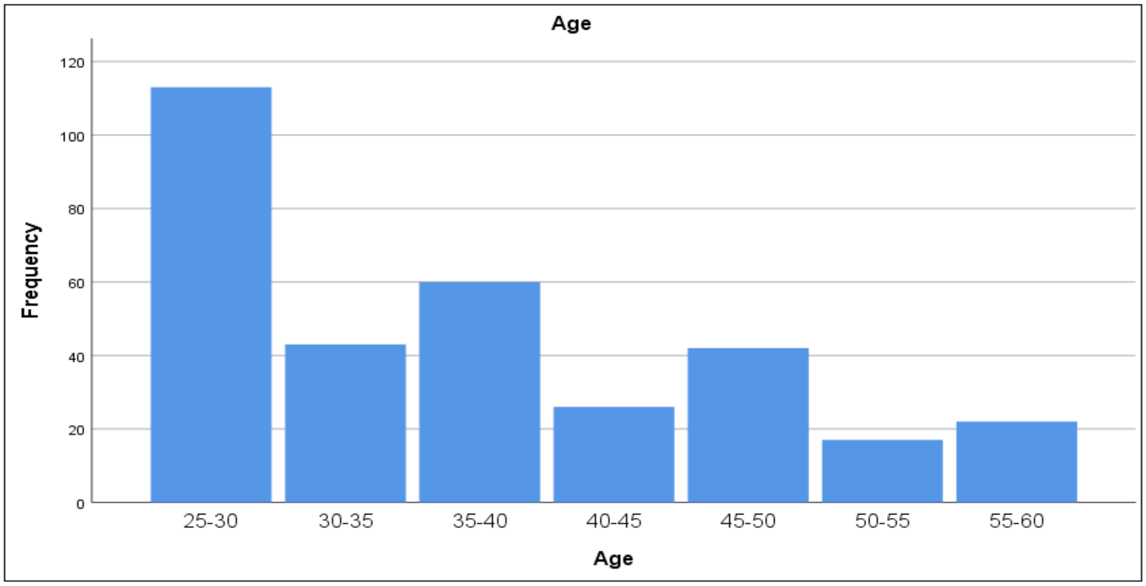

Figure 2: Age wise distribution of the population.

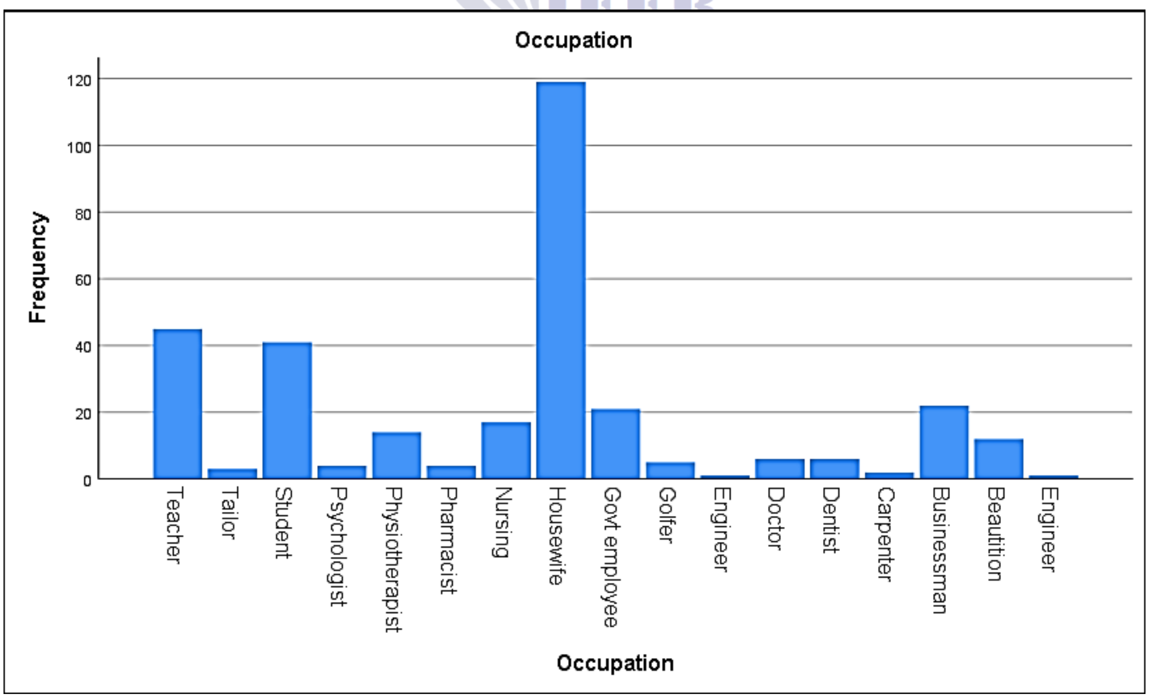

Figure 3: Occupation wise distribution of the population.

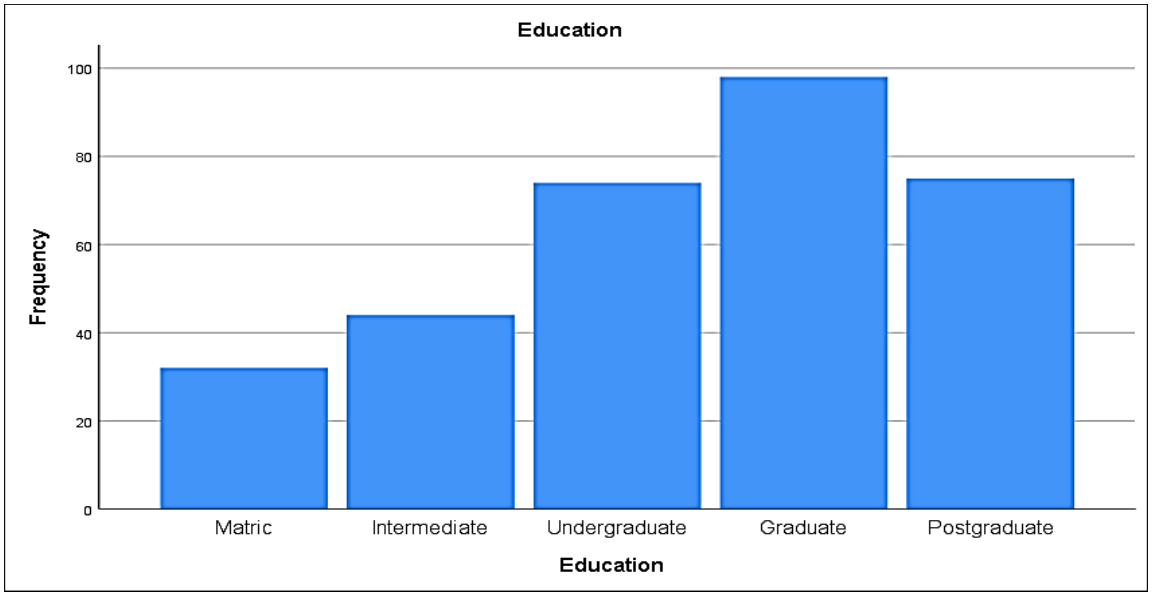

Figure 4: Education wise distribution of the population.

Table 1. Foot problem prevalence in the population represented in the form of percentages.

Foot Problem	Frequency	Percentage
Heel Pain	193	59.2%
Ankle pain	79	24.2%
Ankle sprain	23	7.1%
Nail Problem	28	8.6%
Metatarsalgia	68	20.9%
Flat feet	28	8.6%
Pes Cavus	6	1.8%
Edema	55	16.9%
Others	9	2.8%

The results of the survey revealed that the highest percentage of foot problems reported by participants was heel pain, with 59.2% stating they were experiencing this issue. This finding suggests that heel pain is a common problem among people and may require attention and treatment.

Ankle pain was also reported as a significant issue, with 24.2% of participants stating they were experiencing this problem. Although this percentage was lower than heel pain, it still highlights the prevalence of ankle pain as a foot problem.

The survey results can serve as a valuable insight for healthcare professionals and researchers, enabling them to better understand foot problems and provide appropriate treatments. It also emphasizes the importance of educating people on how to prevent and manage foot problems to avoid complications and discomfort.

3.1. Associating Foot Disorders With Pain Intensity

In this section the association of foot problems with foot pain intensity and frequency has been explained. TABLE 2 relates the percentage of the foot problem with the percentage of foot pain. In simple words, the response of the participants who have reported a foot problem and the level of pain they felt have been reported.

Table 2. Foot pain and the foot problems association.

NPRS Scale	Foot Problems								
	Heel pain	Ankle pain	Ankle sprain	Nail problem	Metatarsalgia	Flat feet	Pes Cavus	Edema	Others
None	43.5%	17.4%	0.0%	21.7%	13%	4.3%	0.0%	13.0%	4.3%
Mild	60.2%	24.1%	6.0%	8.4%	8.4%	4.8%	4.8%	16.9%	0.0%
Moderate	59.9%	23.7%	7.2%	6.6%	24.3%	10.5%	0.7%	17.1%	3.3%
Severe	64.6%	29.2%	10.8%	9.2%	32.3%	10.8%	1.5%	18.5%	4.6%
Total	193	79	23	28	68	28	6	55	9
P value	0.224	0.336	0.101	0.370	0.000	0.091	0.303	0.640	0.205

The p values for the individual case have been reported. The highest cases of foot problems reported in this study belongs to the category of Heel pain, and the percentage recorded is 43.5%. And 64.6% of the respondents stated that they have felt severe pain, but the p-value calculated for this case is 0.224 which shows that there are 20 percent chances of the correctness of the null hypothesis. And the null hypothesis in this case is there is no association between foot pain and foot problems. The p-values in case of Metatarsalgia and flat feet are less than 0.005 which shows the significant association.

3.2. Associating Foot Disorders With Pain Frequency

TABLE 3 aimed to investigate the relationship between foot pain frequency and foot problems. The table presents the percentage of respondents who reported experiencing heel pain and always feeling pain, as well as the p-value calculated for this case.

Table 3. Association between foot problems and frequency of pain.

	Foot Problems								
Frequency of pain	Heel pain	Ankle pain	Ankle sprain	Nail problem	Metatarsalgia	Flat feet	Pes Cavus	Edema	Others
Never	27.3%	18.2%	0.0%	27.3%	18.2%	0.0%	9.1%	9.1%	9.1%
Occasionally	58.9%	16.8%	6.3%	9.5%	6.3%	3.2%	3.2%	13.7%	1.1%

Fairly many times	53.1%	20.4%	10.2%	6.1%	18.4%	10.2%	2.0%	18.4%	2.0%
Very often	61.0%	36.2%	9.5%	5.7%	27.6%	10.5%	1.0%	20.0%	1.9%
Always	69.8%	20.6%	3.2%	11.1%	34.9%	14.3%	0.0%	17.5%	6.3%
Total	193	79	23	28	68	28	6	55	9
P value	0.075	0.018	0.400	0.140	0.00	0.100	0.222	0.741	0.197

According to TABLE 3, 69.8% of respondents who reported heel pain also stated that they always feel pain. This finding suggests that there may be a significant association between heel pain frequency and the experience of always feeling pain. However, the p-value of 0.075 is higher than the standard threshold of 0.05, indicating that this association may not be statistically significant.

The table also reports the p-values for other foot problems, which show mixed strength of association between the variables. Overall, these findings suggest that there may be a complex relationship between foot pain frequency and foot problems. Further research is needed to explore these associations in more detail and to identify potential risk factors and interventions that may help to alleviate foot pain and improve foot health.

3.3. Associating Foot Disorders With Maximum Standing Hours

Association between the hours of standing and the foot problems was also studied. It is highly possible that the people who stand a lot during whole day may have suffered from any of the foot problem that has been studied in this study. The continuous even or uneven load on the foot may result in the development of any foot problem. The problem may get severe for the people who have high weight and are obese. 63.2% of the participants who have reported heel pain were standing more than 8 hours per day, and the level of association is significant (p = 0.003). 31.6% of the population who has reported Metatarsalgia was standing for more than 8 hours. There are high chances of the occurrence of foot pain among the people who stand for long hours.

Adverse foot health effects have been associated with the prolonged standing. Figure 5 shows the association between foot pain frequency and number of standing hours. In Figure 5 people standing for 7-8 hours have stated that they have “Often” felt pain in the feet.

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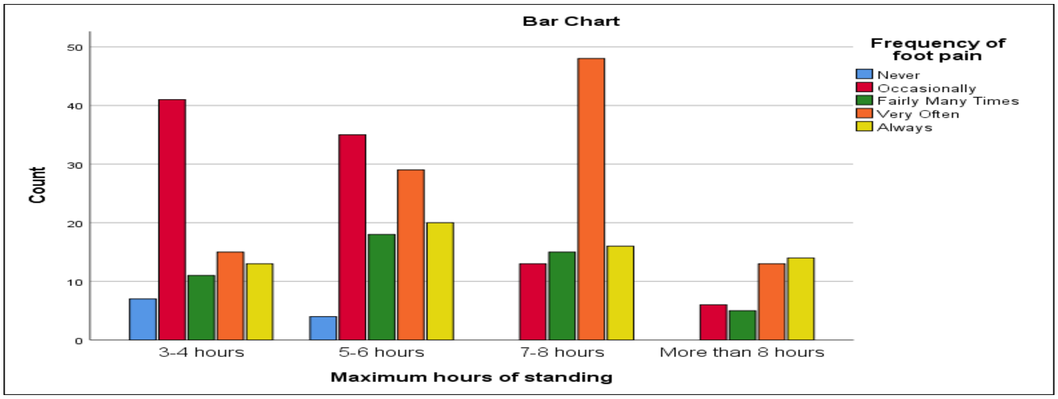

Figure 5: Frequency of foot pain association with the Maximum standing hou

3.4. Associating Foot Health With Occupation

The occupation directly and indirectly affects the quality of life as well as the health of people. People working in the radiation environments are likely to develop certain health related conditions, and people who have got work intensive jobs get affected from the stress. The occupation plays a critical role in defining the health status of a person. The job descriptions of the people belonging to different professions vary a lot, such as the restaurant staff and managers, and gas station staff or beauticians have their role which requires continuous standing. The study focuses on finding the association between foot health and occupation. The focus of the research is to determine that foot health of the individuals get affected by the occupation or not. Figure 6 shows the level of foot pain that the participants have experience during the last week, and the response of the participants has been grouped according to the occupation of the participants.

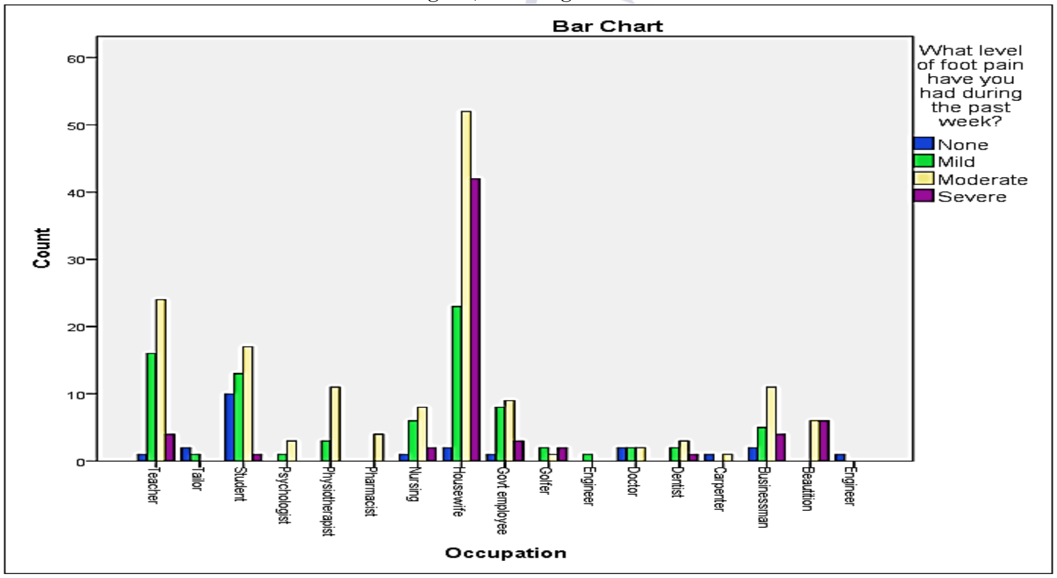

Figure 6: Association between occupation and foot pain experienced.

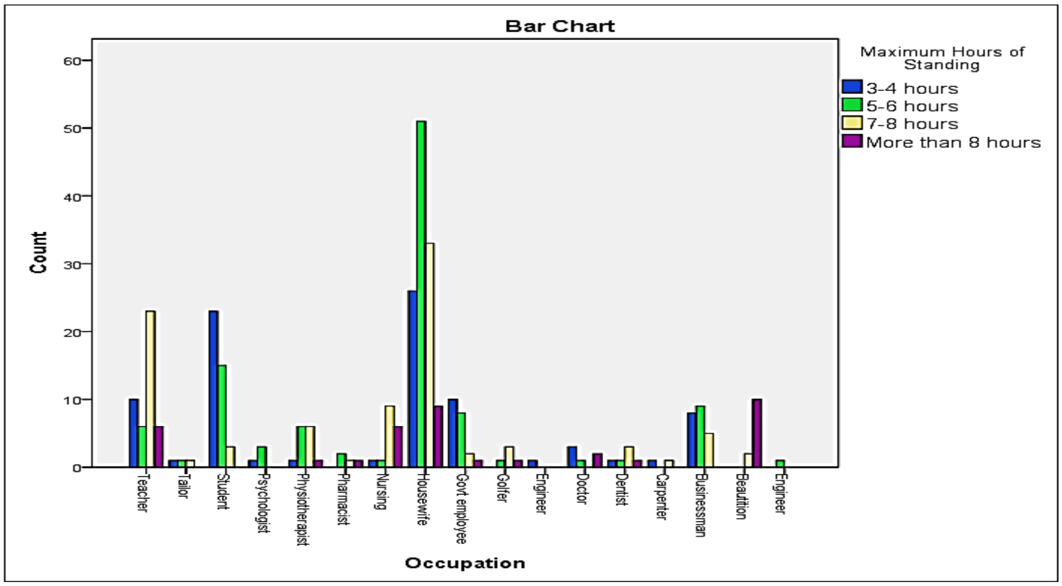

Figure 7: Maximum standing hours and occupation.

The highest population in the current sample is of housewives. And the majority of the housewives experienced moderate and a considerable number of housewives experience severe pains. The reason that the occupation has got a relevancy in determining the foot health is because of the reason that if the job requires long standing hours, then foot health can be affected. People usually stand in different postures while working, and continuously the load is transmitted to the feet, and some of the loads produce deformations that can cause various problems of foot. In Figure 7, the occupation and standing hours are plotted together.

The study indicates that a significant number of housewives have to stand for long hours, with the majority of them standing up to 5-6 hours, while a considerable number stands for 7-8 hours. This finding implies that housewives are at risk of developing various health problems related to standing for long periods. The p-values suggest a significant association between the duration of standing and the level of pain experienced by the participants. This association implies that standing for long hours can lead to moderate to severe pain in various parts of the body, including the legs, back, and neck.

It is noteworthy that the participants with occupations that involve long standing hours are more likely to experience moderate to severe pain. This finding highlights the importance of adopting measures to reduce the duration of standing and provide support to those who have to stand for long periods.

Overall, the study underscores the need to address the health risks associated with standing for long hours, especially for individuals with occupations that involve prolonged standing. Implementing measures to reduce standing duration and provide support can significantly enhance the health and wellbeing of these individuals.

3.5. Associating Foot Health With Footwear

The type of footwear generally defines the overall posture, walking style, therefore the loading patterns as well. There are certain occupations and office requirement that define the type of footwear for the persons that work in that particular vicinity. In the office people usually wear formal shoes, that are flatter in shape and the housewives wear different types of shoes that are not comfortable and suitable from bio-mechanics point of view. Figure 8 shows the different types of footwear that participants usually wear, and the intensity of pain experienced by the participants.

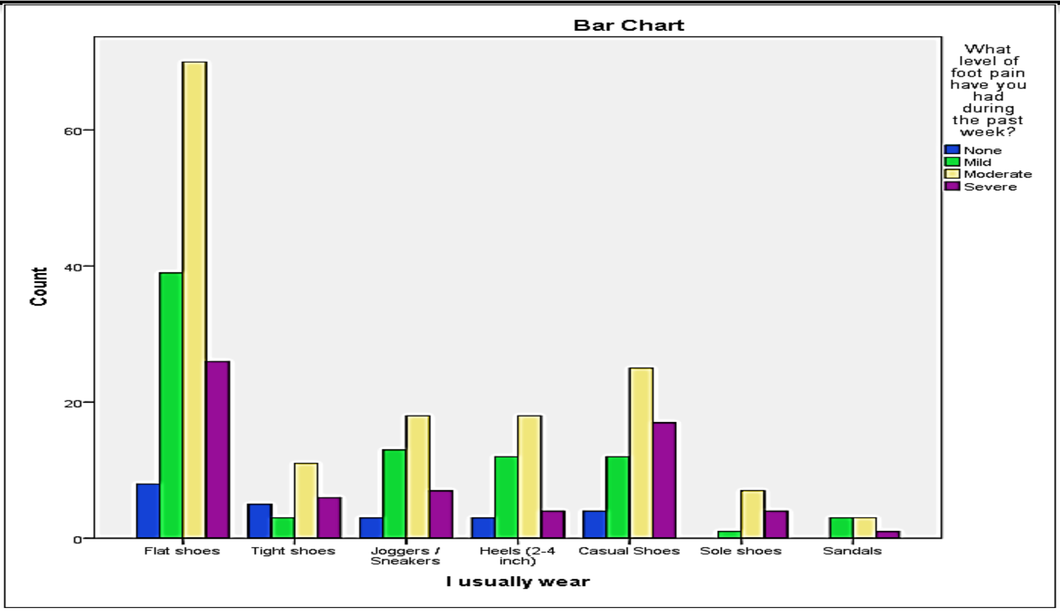

Figure 8: Association between footwear and foot pain.

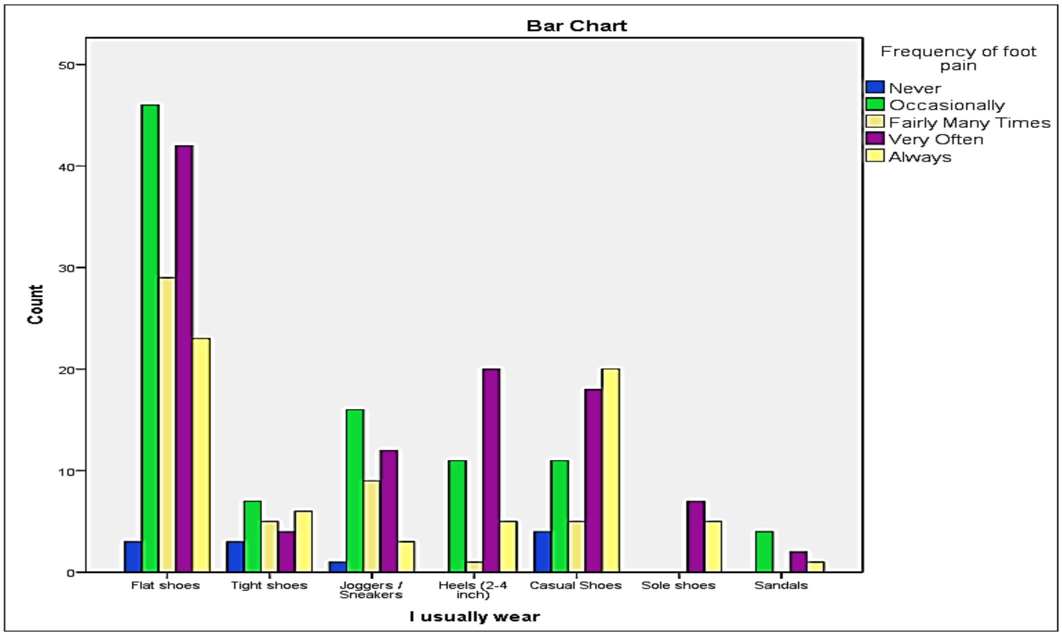

Figure 9: Type of footwear and frequency of the pain

The count of the people that have experienced moderate to severe pain mostly wore flat shoes. The flat shoes are not recommended for good foot mobility. Figure 9 give insight about the frequency of pain that occurred and the type of footwear that participants usually wear. From the graph it is visible that the highest count of people who stated that they feel pain 'always', 'very often', and fairly many times used to wear flat shoes.

4. Automatic detection of foot pain using Machine Learning

Machine learning methods have been applied to predict foot disorders. Machine learning is a type of artificial intelligence that allows computer systems to learn and improve from experience without being explicitly programmed.

4.1. The Dataset

To train machine learning models to predict foot disorders, the dataset is randomly split into two parts: the training dataset and the testing dataset. The training dataset, which contains 75% of the total data, is used to train the machine learning model. During the training process, the machine learning model analyzes the data and learns the patterns that are indicative of different foot disorders.

Once the model is trained, it is tested using the testing dataset, which contains the remaining 25% of the data. The testing dataset is used to evaluate the performance of the machine learning model. The model's performance is measured using different metrics such as accuracy, precision, recall, and F1-score.

4.2. Data Pre-processing

Once the features have been identified, the data was preprocessed to ensure that it is in a format that can be used by a machine learning model. This may include cleaning the data, normalizing it, to handle the categorical variables in the data, the Label Encoder technique was used. This technique converts the categorical labels into numeric form, making them machine readable. This allows the machine learning algorithms to process and make decisions about these variables.

4.3. Feature selection

Feature selection is to identify the features that are most relevant for detecting foot pain. This include age, gender, BMI, shoe type, occupation, weight, intensity of pain, frequency of pain, standing hours etc.

4.4. Machine Learning Models

In order to predict the disorders of the foot, several machine learning algorithms were applied including Random Forest (max depth=4, criterion='gini'), XGBoost (seed=25, nthread=10), Logistic Regression (solver='lbfgs', max_iter=3), KNN (n jobs=10, n neighbors = 1), Decision Tree (criterion='entropy'), Gaussian NB and Ada Boost.

4.3.1. Random Forest

Random Forest is a popular machine learning algorithm used for both classification and regression tasks. It is an ensemble learning method that combines multiple decision trees to produce a more accurate and robust model. Random Forest model with max_depth=4 and criterion='gini' was used for the classification as the data has many features and the goal was to achieve high accuracy and robustness.

4.3.2. XGBoost

XGBoost is known for its scalability, speed, and accuracy. It achieves this by using a variety of techniques, including regularized learning, parallel processing and tree pruning.

The 'seed' parameter in XGBoost is used to set the random seed for reproducibility of the results. The 'nthread' parameter controls the number of threads that XGBoost will use during training.

4.3.3. Logistic Regression

Logistic regression is a popular algorithm used for binary classification tasks, where the goal is to predict the probability of a binary outcome based on one or more input variables. Logistic regression solver='lbfgs' was chosen for high-dimensional dataset. The value of max_iter set as 3, to ensure that the model has enough iterations to converge on a solution.

4.3.4. KNN

K-Nearest Neighbors (KNN) is a non-parametric algorithm used for classification and regression tasks. In KNN, the class of a test instance is predicted based on the class of its nearest neighbors in the training data.

The n_jobs parameter in KNN is used to specify the number of CPU cores to use for parallel processing during the training and prediction phases. By setting n_jobs to 10, KNN will use 10 CPU cores for parallel processing, which can significantly speed up the training and prediction process for large datasets.

The n_neighbors parameter in KNN controls the number of neighbors to consider for making predictions. By setting n_neighbors to 1, KNN will only consider the class of the nearest neighbor for making predictions. This can be a good choice for problems with simple decision boundaries

4.3.5. Decision Tree

Decision Trees are a popular class of algorithms used for classification and regression tasks. In a decision tree, a set of input features is recursively partitioned based on the values of the features, until a decision is made about the class or value of the output variable.
Criterion='entropy' for decision trees was used as working with classification problems and the goal was to separate classes based on categorical features.

4.3.6. Gaussian NB

Gaussian NB is a simple and efficient algorithm that can work well on high-dimensional datasets with relatively few training samples. It is particularly effective for problems with continuous input features that are normally distributed.

4.3.7. Ada Boost

AdaBoost is an ensemble algorithm used for

Table 4. Decision classifier-feature importance.

Features	Importance Order
Weight	1
Occupation	2
Age (year)	3
Height (ft.)	4
Is your foot problem diagnosed by a medical health professional?	5
It is hard to find shoes that do not hurt my feet.	6
Have your feet caused you to have difficulties in your work or activities?	7
I usually wear	8
How many hours of maximum standing you have per day?	9
How much does your foot health limit you climbing stairs?	10
Did you feel full of life?	11
Were you limited in the kind of work you could do because of your feet?	12
What level of foot pain have you had during the past week?	13
Getting up from a chair	14
Have you had any treatment for your foot problem? If yes, then what treatment.	15
How often have you had foot pain?	16
Does your health limited your ability to perform moderate activities, such as cleaning the house, lifting shopping bags, playing golf or swimming?	17
Did you feel tired?	18
In general, how would you rate your overall health?	19
Are you limited in walking long distances?	20
In general, what condition would you say your feet are in?	21
Your foot problem is improving/worsening?	22
Does your health limited your ability to perform vigorous activities, such as running, or lifting heavy objects or participate in strenuous sports?	23
How much does your foot health limit you walking?	24
Are you limited in walking short distances?	25
Are you limited in dressing yourself?	26
Gender	27
Are you Diabetic	28

classification and regression tasks. It is a meta-algorithm that combines multiple weak classifiers or regressors into a single strong classifier or regressor.

5. Results and Discussions

It is important to note that the choice of algorithm and hyper parameters can greatly impact the accuracy and effectiveness of the prediction model. Therefore, it is essential to carefully select and fine-tune the algorithms and parameters to achieve the best possible results.

The quality of life related to foot health is influenced by several factors [2] including footwear, general health, and physical activities. In a recent study, the impact of footwear, occupation, and standing hours on foot health was investigated. The results of this study showed that weight was the most important factor affecting foot health, followed by occupation.

The decision classifier presented in Table 4, showing the most important features that participated or contributed to learning. The Random Forest algorithm with a maximum depth of 4 and criterion of 'gini' was found to be the most effective in predicting foot disorders.

Table 4, presented in the study highlights the importance of weight in relation to foot health. This finding suggests that maintaining a healthy weight is crucial for preventing foot disorders and maintaining good foot health. Occupation was also found to have a significant impact on foot health. People who stand for long periods of time as part of their job are at an increased risk of developing foot problems. This finding emphasizes the importance of wearing appropriate footwear and taking breaks to rest the feet while on the job.

The study also utilized predictive modeling to identify the most important factors for predicting foot disorders. The study found that weight and occupation were the two most significant factors associated with the development of foot disorders.

Excess weight places increased stress on the feet, increasing the risk of developing conditions such as plantar fasciitis. In addition, occupations that require prolonged standing, walking, or heavy lifting can also increase the risk of foot disorders due to the repetitive stress placed on the feet.

For individuals with occupations that require prolonged standing or heavy lifting, healthcare professionals can provide advice on appropriate footwear and foot support to reduce the risk of foot injury. Additionally, taking frequent breaks to rest and stretch the feet can also help prevent the development of foot disorders.

The identification and understanding of the most important factors associated with foot disorders is critical for healthcare professionals to develop effective prevention and treatment strategies. By targeting these factors, healthcare professionals can improve foot health, reduce the burden of foot disorders, and enhance the quality of life for their patients.

The findings of the study are presented graphically in Figure 11, which shows the predicted number of foot disorders based on weight and occupation. This visualization helps to convey the importance of these factors in relation to foot health and can aid in the development of effective interventions and treatment plans.

Overall, the study highlights the importance of maintaining a healthy weight, wearing appropriate footwear, and taking breaks to rest the feet when standing for long periods of time. By understanding the impact of these factors on foot health, healthcare professionals can work to improve the quality of life related to foot health for their patients.

Plantar Fasciitis is a common condition that affects the plantar fascia, a thick band of tissue that runs along the bottom of the foot. The plantar fascia plays an important role in supporting the arch of the foot and absorbing shock during walking and running. However, repetitive stress and strain on the fascia can cause tiny tears to develop, leading to inflammation and pain.

The most common symptom of plantar fasciitis is heel pain, which is often described as a sharp, stabbing pain that is worse in the morning or after periods of rest. The pain can also be accompanied by stiffness and discomfort in the arch of the foot. In severe cases, the pain can be quite debilitating and can affect a person's ability to walk or perform daily activities.

According to recent research, the count for the Plantar Fasciitis cases has risen to more than 175, which is a cause for concern. This means that more and more people are suffering from this condition, and it is important to find effective treatments that can help alleviate the symptoms and prevent further damage.

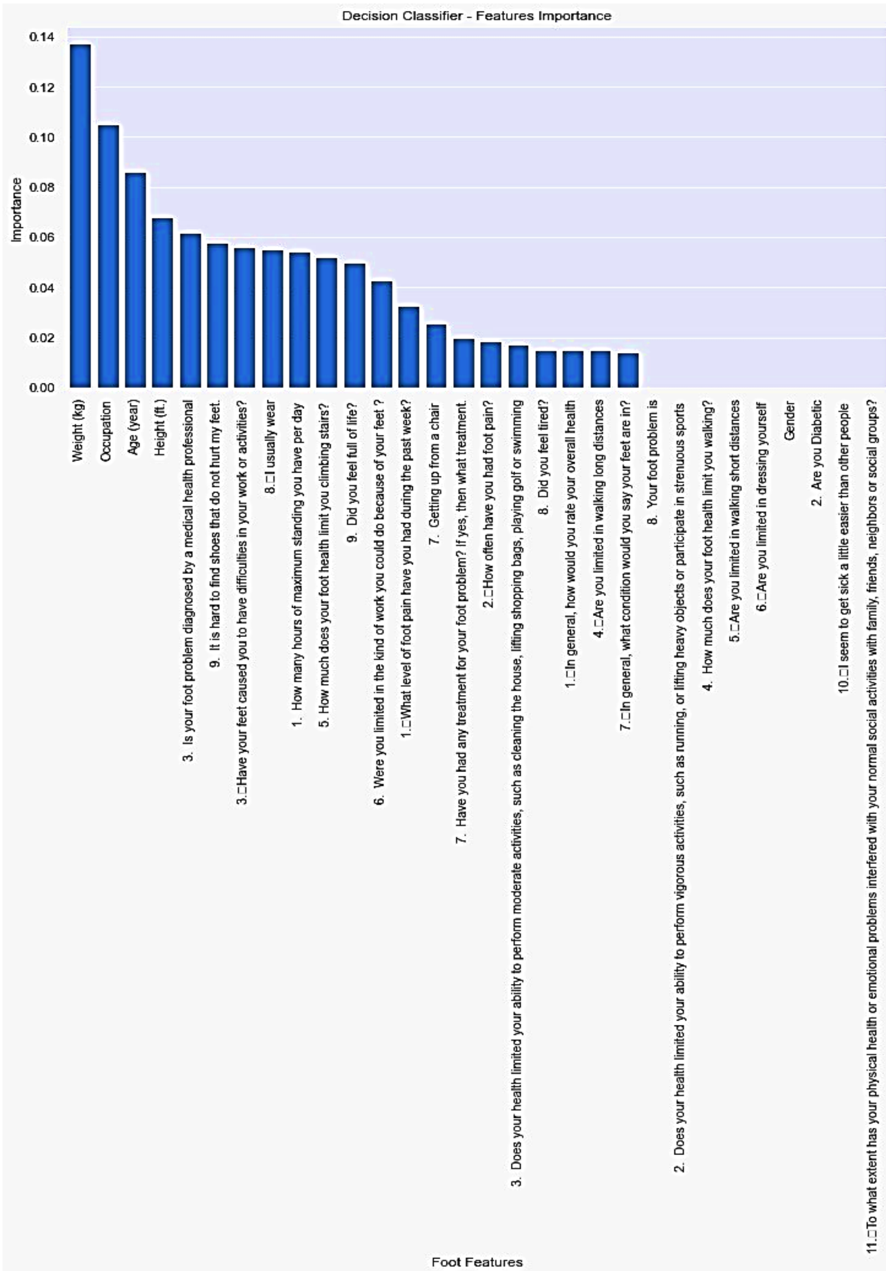

Figure 10: Foot Problem Prediction.

Table 5. Accuracy of machine learning methods applied.

#	Algorithm	Accuracy	Precision	Recall	F1 Score
4	GaussianNB	**66.666667**	67.123288	94.230769	78.400000
1	Random Forest	65.432099	70.689655	78.846154	74.545455
2	XGBoost	65.432099	76.086957	67.307692	71.428571
6	Logistic Regression	64.197531	65.753425	92.307692	76.800000
5	KNN	59.259259	72.093023	59.615385	65.263158
0	Decision Tree	58.024691	68.750000	63.461538	66.000000
3	Ada Boost	51.851852	64.444444	55.769231	59.793814

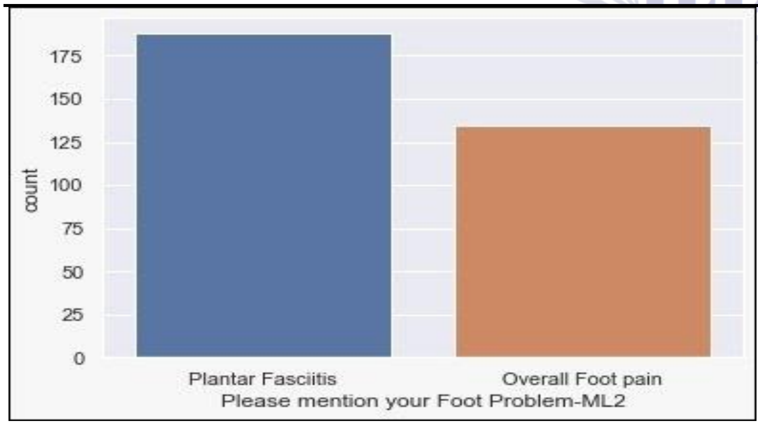

Figure 11: Foot Problem Prediction.

In Table 5 the precision and accuracy of the models are listed, providing important information about their effectiveness and reliability by using these models, doctors and healthcare professionals can better understand the underlying causes of Plantar Fasciitis and tailor treatments to the individual needs of each patient. This can help reduce pain, improve mobility, and prevent further damage to the foot.

In conclusion, the rise in Plantar Fasciitis cases is a cause for concern, but the development of new models and techniques provides hope for more effective treatments in the future. By focusing on precision and accuracy, we can better understand this condition and provide better care for those who suffer from it.

6. Conclusion

The statistical analysis has clearly shown the association of the foot health with the occupation, footwear, and number of standing hours. The p-values support the hypothesis. Overall, the foot pain has proven to be a considerable indicator for the existence of the foot problem. The weight and BMI play a critical role in defining the foot health and overall condition of the feet. The foot disorders have been found to be associated with the pain intensity, pain frequency, and maximum standing hours. There also existed the association between foot health and footwear. The associations highlighted by the statistical analysis between the variables is compared with the feature highlighting or decision classifier results of the machine learning. The occupation and weight have been highlighted as one of the most important features in determining the foot disorders.

Author Contributions:

Imad Ullah (I.U.) led the study design, methodology, software development, data curation, visualization, and project administration. He also contributed to drafting the manuscript. Naseer Ullah (N.U.) contributed as a software engineer, supporting system design, coding, model optimization, and integration of machine learning algorithms with clinical datasets. Qaisar Aziz (Q.A.) performed the formal analysis and contributed to methodology and resources. Syed Ibrahim (S.I.), provided expertise in mathematical validation and interpretation of clinical data. He also assisted in visualization and manuscript preparation. Hamza Hummam (H.H.) and Shahzad Khan (S.K.) contributed to technical review and provided academic guidance.

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