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An Analytical Data Model to Improve Benefits of the Comprehensive Health Insurance System
By Data Mining Techniques

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Abstract— Health insurance represents a crucial safeguard against the myriad risks associated with individual health conditions, covering expenses related to examinations, diagnosis and treatment, as well as providing psychological and physical support. Until mid-2019, Egypt implemented a social health insurance system, and then moved to a renewed framework known as the comprehensive health insurance system in the latter half of 2019. The research at hand focuses on exploring a new mechanism through develop a new model, it can be help the General Authority for Health Insurance to attainment of maximum benefits, whether in terms of individuals medical services or the enhancement of the nation's overall income return.

The researcher depends on using the data mining technique to conduct specialized analyzes of big data for the new model, to offer the numerous advantages, including empowering decision-makers to make accurate decisions based on reliable information and proficient data analysis, Based on the new model for the health insurance system that was prepared and implemented using the Weka program, version 3.8.6, through the classifier scheme (classifiers.trees.J48 algorithm), the applied pattern was used:

(Scheme:weka.classifiers.misc.InputMappedClassifier -I -trim -Wweka.classifiers.trees.J48 -- -C 0.25 -M 2), Through the Weka program, a new model was designed that contains two parts. The first part is to classify the insured into insurance categories according to their monthly salaries, and the second part is to predict the classification and distribution of employees among insurance packages according to the new health insurance model. The model was prepared using Weka.classifiers.trees.J48. software to analysis the dataset of 2781 employees.

One of the significant outcomes that the researcher emphasizes from implementing the new model is the attainment of maximum benefits, whether in terms of individual medical services or the enhancement of the nation's overall income return. Under the existing health insurance law in Egypt, the monthly subscription fee is a flat 1% for all employees, without accounting for other factors. The results of applying the new model showed the effectiveness of the model through a comparison between the current subscription fees and the new health insurance model, developed using the same dataset of 2781 employees, reveals that the total monthly subscription fees under the current health insurance system amount to 153057.97 Egyptian Pounds (L.E.), whereas the total subscription fees under the new health insurance system model reach 365998.91 L.E., The financial benefits realized from the new model amount to 212940.94 L.E., representing a percentage increase of up to 139.12%. This demonstrates a considerable improvement in financial outcomes, and the potential advantages of transitioning to the new health insurance model.

Keywords-— *Comprehensive Health Insurance System (CHIS), Analytical Data Model, Data Mining Techniques, Improvement of Health Insurance Benefits, Universal Health Coverage (UHC), Universal Health Insurance System (UHIS), Wweka.classifiers.trees.J48.*

I. INTRODUCTION

Health insurance can be regarded as a crucial method for delivering healthcare to both individuals and groups. It operates within a social system founded on cooperation and interdependence among individuals, aimed at collectively bearing the financial burdens that may be challenging for one person to handle alone. Insurance companies play a pivotal role in organizing the distribution of risks for a predetermined fee, ensuring the implementation of effective strategies to secure comprehensive healthcare. This program can be administered by government institutions or private companies, underscoring the diverse approaches to healthcare provision within different sectors of society.

Various countries implement health insurance systems with distinct policies, laws, and legislation governing aspects such as the individuals covered, coverage ratios, funding sources, and subscription collections. The diversity in approaches reflects the unique healthcare structures and priorities of each nation.

The inception of health insurance can be traced back to 1883 when Germany issued the first health insurance policy. In the Arab world, a notable milestone occurred in 1957 when the first document written in

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Arabic to secure medical treatment was established in Egypt. This document, involving the United Insurance Company and the Bank of Alexandria, marked a significant step forward. Additionally, another document was issued in the same year between the Misr Insurance Company and Asustander Petroleum Services Company, contributing to the early development of health insurance practices in the region. These historical moments underscore the evolution and global significance of health insurance as a means to enhance healthcare accessibility and provision. [1]

The origins of health insurance in Egypt trace back to 1964 with the establishment of social health insurance. This marked a pivotal moment, introducing a significant system for the provision of healthcare services. The initiation of social health insurance was preceded by the enactment of numerous legislations that primarily targeted the workforce, encompassing both workers and employees. These legislative measures were specifically designed to address aspects related to the work environment, work-related injuries, compensation, and various models of satisfactory care. The implementation of social health insurance in 1964 laid the foundation for a comprehensive healthcare system, reflecting a commitment to the well-being of the working population and emphasizing the importance of addressing health-related challenges within the Egyptian context [2]

On January 11, 2018, Law No. 2 of the new comprehensive health insurance system was officially issued and later applied from the second half of 2019 to the present. However, a significant challenge arises in the implementation of this new system: the collection of a monthly subscription for health insurance from all segments of the population in fixed percentages. According to the law, each person is required to pay a fixed 1% of the insured amount, regardless of the substantial variation in monthly income among members of Egyptian society. This approach is deemed inappropriate and unfair, particularly for the limited and middle classes [3].

The new comprehensive health insurance law lacks consideration for differences in the size of monthly income and monthly expenses per person. It fails to stratify Egyptian society based on these financial parameters, which can potentially impede the efficient provision of medical coverage. The absence of a nuanced approach may result in insufficient financial resources available for hospital preparations and the procurement of essential medical devices and supplies. The state bears many expenses that affect its budget

Furthermore, individuals from lower-income classes bear disproportionately high rates of medical coverage costs, including 10% of the total cost per family member for radiology, medical tests, and provision of medicines. Additionally, there is a 5% charge for services in the hospital's internal departments, and additional costs for home medical visits. These financial burdens are in addition to the monthly subscription fees for each person. The cumulative impact of these financial obligations poses challenges, especially for those in the lower economic strata, potentially hindering their access to necessary healthcare services.

II. RELATED WORK

The research [4] has been explained he Thai government introduced the Universal Coverage Program (UCS) in 2002, aiming to enhance accessibility and utilization of healthcare services. This study delved into the patterns of health-seeking behavior among beneficiaries of healthcare services in Thailand, examining the social and contextual factors influencing these patterns. The findings indicated that, from a vertical justice perspective, UCS effectively addressed the needs of beneficiaries, particularly in the lower income group. This group exhibited higher healthcare needs, received more services from specific facilities, and incurred lower costs for both inpatient and outpatient services. However, the study revealed a significant portion of beneficiaries still resorting to off-network services, suggesting potential gaps in achieving universal access from a horizontal equity standpoint. To address this, the policy should focus on expanding and diversifying the benefits of its services to reinforce horizontal equity. This might involve greater involvement of the private sector, especially for employees, and addressing the unmet health needs of individuals residing in rural areas. Consequently, policy priorities should be directed toward these areas. In conclusion, the study recommends ongoing efforts to broaden the scope of UCS services, ensuring equitable access and meeting the diverse healthcare needs of the population. Additionally, methodological aspects such as severity modulation and detailed classification of health-seeking behaviors warrant further investigation to comprehensively understand the policy's impact.

The research [5] has presented analytical study focuses on the health insurance market in the Kingdom of Saudi Arabia (KSA). The examination delves into the health insurance services offered within the cooperative system framework, managed by service providers under the auspices of the Council of Cooperative Health Insurance. This service is obligatory for its intended beneficiaries, namely expatriates working in the private sector and their dependent family members.

The study evaluates seven key indicators, including policyholder gross premiums, net totals, claims settled, gross service promotion commissions, extent, coverage, and customer retention rates, as well as current and cumulative market surplus rates. Through comprehensive research and analysis, the study draws a noteworthy conclusion: the health sector in the Kingdom of Saudi Arabia significantly shapes the landscape of the insurance market. All indicators studied point to the fact that health insurance constitutes more than 50% of the total insurance market in the Kingdom. This underscores the substantial impact and prominence of the health insurance sector within the broader insurance landscape in Saudi Arabia.

The research [6] suggests that several measures have been implemented to promote and support the Universal Health Coverage (UHC) policy in Thailand. These measures include increasing revenues, optimizing the use of resources, reducing variations across health insurance plans, and enhancing the overall quality of healthcare. The UHC policy, driven by specialized services, prioritizes a people-centered approach, emphasizing its positive impact on health outcomes, societal resilience, and economic well-being. The research anticipates that the UHC policy will yield valuable and sustainable improvements in health system performance and the overall health of the population.

Notably, primary care has been a focal point in the ongoing healthcare reform efforts in Thailand since the 1970s. National policies have played a pivotal role in expanding the number of health facilities and the health workforce, as well as extending financial coverage

[1] Published by: https://ar.wikipedia.org/wiki, Retrieved on 11 February 2021.

[2] Published by: http://www.hio.gov.eg/Ar/presidency/prief/Pages/default.aspx, Retrieved on 11 February 2021.

[3] Published by: https:// منشورات | 2018 لسنة 2 رقم الشامل الصحي التأمين نظام قانون قانونية (manshurat.org), Retrieved on 11 February 2021.

[4] Seung Chun Paek,1 Natthani Meemon,1 and Thomas T. H. Wan: Thailand's universal coverage scheme and its impact on health-seeking behavior, Springerplus. 2016, Published online 2016 Nov 10.

[5] Hussein bin Mohammed Borai: Analytical study of the health insurance market in KSA, Department of Health Services and Hospitals Administration - College of Economics and Administration, King Abdulaziz University.

[6] Kanitsorn Sumriddetchkajorn, Kenji Shimazaki, Taichi Ono, Tesshu Kusaba, Kotaro Sato,c and Naoyuki Kobayashi, Universal health coverage and primary care, Thailand. Bull World Health Organ. 2019 Jun 1, ublished online 2019 Apr 1.Universal health coverage and primary care, Thailan

throughout the country. The transformation of primary care has shifted from its traditional role of providing basic disease-based care to becoming the first point of contact in an integrated, coordinated, community-oriented, and person-centered care model. This transition emphasizes the need for prioritizing the national health budget to support comprehensive primary care services, reflecting a commitment to enhancing the accessibility and quality of healthcare services for the Thai population.

The research [7]conducted a comparative analysis titled "Comparisons of Health Insurance Systems in Developed Countries," examining the application of health insurance systems in five countries: Canada, Germany, Japan, the United States of America, and Singapore. The study sheds light on the diverse ways in which healthcare insurance programs operate globally, emphasizing that most country systems can be understood as combinations or variations of the five systems outlined in the research. The research acknowledges the complexity of healthcare systems worldwide and the challenges in identifying the characteristics of the most effective and equitable systems. While it would be desirable to pinpoint these features, the paper acknowledges the limitations of doing so within its current scope. The complexities involved require a more extensive examination that extends beyond the boundaries of the current research.
The paper suggests that there are several excellent surveys available that provide in-depth insights into the healthcare systems of different countries. This recognition underscores the need for comprehensive investigations and analyses to fully understand the nuances and effectiveness of various healthcare insurance models around the world.

The study [8] aimed to review and evaluate a health insurance scheme with reference to the General Insurance Corporation in. The research focused on the health insurance sector in India, highlighting certain shortcomings and challenges. The study revealed several issues, including the concentration of most insurance schemes in the sector on the middle and upper classes of the population, leaving the rural and semi-urban populations neglected in terms of accessing health insurance services.
One of the findings indicated that individual health insurance schemes are less popular among people compared to group health insurance policies. Additionally, there is a general lack of awareness among the public about the benefits and importance of health insurance products. These identified problems underscore the need for addressing disparities in the distribution of health insurance services and improving public awareness to ensure more comprehensive coverage and accessibility across different segments of the population in India.

The research [9]provides an analysis of the Health Insurance Schemes offered by the Oriental Insurance Company Limited. The study collected information from 100 respondents who were Health Insurance Policyholders in Tirunelveli Town. The analysis reveals that life coverage plays a crucial role in the Oriental Insurance Company Scheme, and policyholders anticipate extended services. The findings suggest a need for a review of existing health insurance products to ensure profitability.

Several recommendations emerged from the analysis. The research suggests the importance of creating a separate apex body for regulating health schemes and monitoring fraudulent claims. Additionally, there is a call for fixing prices for health insurance products. The study emphasizes the significance of paying attention to the needs of unemployed individuals, disabled persons, and employees working in unorganized sectors when framing health insurance products.
Given the economic context of India as an underdeveloped country, the research underscores the challenge posed by the low per capita income of citizens. This economic consideration is a critical factor to be considered when designing and implementing effective health insurance products in the country.

The research [10]aimed to comprehend the pattern of health insurance awareness and consumption across various demographic groups and to understand the determinants influencing consumer purchase decisions in health insurance in the state of Kerala. The specific objectives included: a) Identifying factors that distinguish an insurance subscriber from a non-subscriber. b) Proposing an integrated model by connecting dominant factors that influence an individual's health insurance purchase decision.
The researcher ensured a representative sample by distributing it across the three geographical regions of the state of Kerala, with each region having an adequate sample size to provide an equal chance for all members. Given that critical factors such as education, income levels, and awareness of health insurance are widely distributed and nearly uniform in the state, the findings from the sample can be considered a fair representation of the population and close to generalization for the state's behavior on the subject. The study gains significance with the government of India and the state focusing on achieving a target of 20% health insurance coverage by 2015. In an environment of rising healthcare costs and increasing health concerns, a substantial section of society not covered by government schemes looks to private and public sector health insurance companies. The research explores critical aspects of consumer behavior that are vital information for health insurance marketers. Areas such as awareness, the impact of the overall environment, and consumer responses to these developments are crucial for government agencies and NGOs involved in promoting health insurance.

III. COMPREHENSIVE HEALTH INSURANCE SYSTEM ANALYSIS (DIFFERENT MODELS)

A. comprehensive health insurance system in Egypt

In [11]the current scenario of a new health insurance system in Egypt is elucidated. The objective of this new system is to establish a unified and comprehensive health system that is not only more effective but also ensures the delivery of high-quality healthcare services to Egyptian citizens. A key aspect of this initiative involves redirecting state resources to finance subscriptions for those who are unable to bear the costs as beneficiaries of the new system.
The implementation of the new system is planned to occur gradually in stages. The initial focus will be on governorates that are most prepared in terms of infrastructure, with ongoing efforts to enhance the infrastructure of subsequent stages. This phased approach aims to

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[8] Ku Pushpinder Kaur Benipal. An Evaluated Study of Health Insurance Scheme in Reference to General Insurance Corporation, Commerce Faculty, Pt. Ravishankar Shukla University Ph. D. Degree, Research Centre, Durga Mahavidyalaya Raipur C.G.2016.

[9] S. MONICA PETER, M. An Analysis of Health Insurance Schemes of Oriental Insurance Company Limited, Dissertation Submitted to Manonmaniam Sundaranar University in partial fulfillment of the requirement for the award of the degree of Master of philosophy in Commerce, Department of Commerce, School of Business Studies, Manonmaniam Sundaranar University, TIRUNELVELI-627012.

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[11]Published by: https:// منشورات | 2018 قانون نظام التأمين الصحي الشامل رقم 2 لسنة قانونية (manshurat.org), Retrieved on 11 February 2021.

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guarantee the provision of high-quality health services to all citizens across Egypt.

The comprehensive health insurance system is designed to be inclusive, encompassing all groups of the Egyptian population. The overarching goal is to achieve comprehensive health coverage, embodying the principle of social solidarity. This involves extending the umbrella of insurance protection to all citizens within an integrated system that ensures the delivery of high-quality health services while achieving financial solvency.

Crucially, the new system is envisioned to gradually shift its reliance on the public treasury, ultimately becoming financially sustainable as a standalone system. This strategic shift is aimed at ensuring the long-term viability and independence of the comprehensive health insurance system in Egypt.

B. Health Insurance System in UK (National Health Service (NHS))

In Paper [12] the United Kingdom's government-sponsored universal healthcare system, known as the National Health Service (NHS), is highlighted. The NHS comprises publicly funded healthcare systems across the UK, including the National Health Services in England, NHS Scotland, NHS Wales, and Health and Social Care in Northern Ireland. Citizens are entitled to healthcare services under this system, and they also have the option to purchase private health insurance.

The NHS Plan outlined various commitments to enhance the healthcare system, including providing more power and information for patients, increasing the number of hospitals and beds, augmenting the healthcare workforce with more doctors and nurses, reducing waiting times for appointments, improving healthcare for older patients, and enforcing stricter standards for NHS organizations.

A study comparing the efficiency of healthcare systems in seven industrialized countries found that the UK's healthcare system is one of the most efficient globally. The Commonwealth Fund report evaluated performance in five areas: quality, efficiency, access to care, equity, and healthy lives. While the Netherlands ranked first overall, the UK closely followed in second place, demonstrating strong performance in quality of care and access to care. Notably, the UK secured the top spot in efficiency, reflecting its prudent management of national healthcare spending relative to GDP and the allocation of resources to healthcare administration and insurance.

In [13] the objectives of the National Health Service (NHS)

- The NHS provides a comprehensive service, available to all
- Access to NHS services is based on clinical need, not an individual's ability to pay
- The NHS aspires to the highest standards of excellence and professionalism
- The patient will be at the heart of everything the NHS does
- The NHS works across organizational boundaries
- The NHS is committed to providing best value for taxpayers' money
- The NHS is accountable to the public, communities and patients that it serves
- Commitment to quality of care

C. comprehensive health insurance system in Kingdom of Saudi Arabia

In [14] represented the cooperative health insurance system implemented by the Kingdom of Saudi Arabia a regulation of a law has been drawn up to work with, which allows companies to provide medical services through either the company's medical units prepared and equipped for this, and it was approved in accordance with the regulation of the Cooperative Health Insurance Law issued by the Kingdom in 2013 by Ministerial Resolution 9/35/1 and amended by Ministerial Resolution 1215 by contracting with one of the health insurance companies located in Saudi Arabia, which has been qualified for this and obtained a work permit within the list of the cooperative health insurance system.

In [15] represented a health insurance policy for the insured, which includes:

- Medical examination of all diseases, treatment and provision of medicines in its affiliated clinics.
- Preventive measures are taken for both the mother and the child to be cared for, and vaccinations are provided for them.
- In addition, laboratory and radiological examinations are performed for the patient.
- The patient is residing in hospitals affiliated with the health insurance in order to perform operations and also give birth, and they are cared for after the operation.
- All diseases that are related to the teeth and gums are also treated, but the installation of dentures or orthodontics is not provided.
- The competition between health insurance companies, each company has developed a set of options that allow the employer / the insured to choose the most suitable for him in terms of value compared to the volume of service.

D. Universal Health Coverage in Thailand

In Paper [16] represented Thailand's policy on universal health coverage (UHC) has made good progress since its inception in 2002. Every Thai citizen is now entitled to basic preventive, curative and palliative health services at all stages of life, like their counterparts elsewhere, but the universal health insurance system faces challenge. The four insurance programs aim to cover the entire population. However, both MWS and VHCS had operational problems, causing nearly 30% (about 18 million people) to be unsecured by 2001. MWS suffered from wrong -targeting problems due to difficulties in assessing the income of those employed in the informal employment sector. A 2000 household survey indicated that only 35% of all MWS recipients met the MWS eligibility criteria and VHCS suffered from adverse selection issues. A study, possibly due to its voluntary nature, found that the presence of the disease was positively associated with the purchase and use of VHCS.

Subsequently, the Thailand's government created the UCS program in 2002 by merging the MWS and VHCS programs. Currently, three health insurance programs for the entire population are implemented, namely CSMBS (9%), Social Security System (16%), and UCS (75%)

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[12] Josh Chang, Felix Peysakhovich, Weimin Wang and Jin Zhu, the UK Health Care System.

[13] Published by: The NHS Constitution for England - GOV.UK (www.gov.uk), Retrieved on 26 March 2022.

[14] Published by: The executive regulations for the cooperative health insurance system, Amended by Ministerial Resolution issued in January 28, 2021, P: 17, https://www.cchi.gov.sa/, Microsoft Word - اللائحة التنفيذية لنظام الضمان الصحي التعاوني تعديل (٦) (1).docx (cchi.gov.sa), Retrieved on 8 February 2022.

[15] Published by: https://www.almaal.org/health-insurance-for-saudis-residents-and-employment, Retrieved on 11 February 2022.

[16] Seung Chun Paek,1 Natthani Meemon,1 and Thomas T. H. Wan: Thailand's universal coverage scheme and its impact on health-seeking behavior, Springerplus. 2016, Published online 2016 Nov 10.

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Table 1 presents the characteristics of the three health insurance programs in brief.

IV. DATA MINING TECHNIQUES

[17]Data mining plays a crucial role in various applications, encompassing pattern recognition, forecasting, and learning. Utilizing techniques and algorithms like classification, clustering, and others, data mining aims to unveil patterns that can aid in predicting future business trends. Widely recognized as a pivotal frontier in database and information systems, data mining stands as one of the most promising multidisciplinary advances in information technology. Its applicability extends across diverse industries where data is generated.

Several algorithms and methods contribute to the effectiveness of data mining. Some notable techniques include:

1. **Classification:** Involves categorizing data into predefined classes or groups based on certain characteristics. This method is valuable for predicting categorical outcomes.
2. **Regression:** Focuses on analyzing the relationships between variables, enabling the prediction of numerical outcomes.
3. **Clustering:** Involves grouping similar data points together, providing insights into the inherent structures within the dataset.
4. **Association Rules:** Identifies relationships between variables and uncovers patterns in data, often used in market basket analysis.
5. **Neural Networks:** Mimics the structure and function of the human brain to recognize complex patterns and relationships in data.
6. **Genetic Algorithms:** Utilizes principles inspired by natural selection to optimize solutions for complex problems.
7. **Nearest Neighbor:** Assigns new data points to the class of the majority of their nearest neighbors, often used in classification tasks.
8. **Decision Trees:** Represents decisions and their possible consequences in a tree-like structure, aiding in decision-making processes.

The versatility of data mining techniques makes them applicable across a wide array of industries, where the extraction of valuable insights from data is paramount.

V. CREATE A NEW MODEL FOR COMPREHENSIVE HEALTH INSURANCE SYSTEM

The researcher is dedicated to the development of a novel model that aims to optimize the benefits of the comprehensive health insurance system in Egypt. The primary focus is on ensuring that Egyptian citizens receive distinguished health services in exchange for fair financial subscriptions to the government, taking into consideration the financial constraints of low-income individuals, thereby achieving value for the price paid. The key features of the proposed model include:

Improvement of Comprehensive Health Insurance Benefits: The model endeavors to enhance the benefits of the comprehensive health insurance system by establishing a national income framework. This framework is designed to facilitate the success of the system, ensuring the delivery of medical services that align with the financial contributions made by individuals. The emphasis is on achieving a balance between the perceived value of the services and the corresponding financial commitment, embodying the principle of value versus price.

Equitable Insurance Subscriptions: Recognizing the diversity in salaries and pensions, the proposed model prioritizes fairness by providing subscription options that align with the income levels of the insured or those not engaged in formal employment. This approach ensures that the financial burden is proportionate to the individual's economic circumstances.

Diverse Medical Packages: The model introduces a range of medical packages, allowing insured individuals to choose the one that best suits their needs. In cases where individuals wish to upgrade to a higher-tier package, flexibility is provided. This diversity in medical packages is designed to cater to the varied healthcare requirements of the insured population, enhancing the overall accessibility and quality of healthcare services.

In summary, the proposed model is a comprehensive approach that not only seeks to optimize the benefits of the health insurance system but also places a strong emphasis on fairness, flexibility, and value for the financial contributions made by individuals as showing in Figure1.

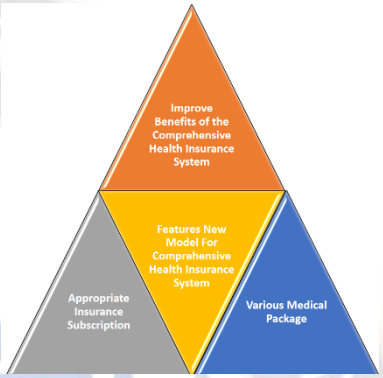

Figure 1: Showing the Most Important Features for New Proposed Model

The design of this model specifically caters to individuals residing within Egypt and holding Egyptian nationality. The model is structured into two primary components:

- Employment, Pension Status, Student or Unemployed:

They are categorized into distinct slices, each representing a specific income range. The subscription fee for health insurance varies based on the type of slice.

- A variety of different medical packages:

Each one can be chosen one from 3 medical packages as showing in Figure2

Figure 2: Showing Creating the New Model for the Comprehensive Health Insurance System for the Egyptian Citizen

VI. DATA MODELING AND ANALYSIS APPROACH

data modeling is typically done in seventh stages. The first stage is defining dataset and requirements, the second stage is collecting data, the third stage is organizing the data, the fourth stage is defined techniques and tools, the fifth stage is data check and verified, the sixth stage is building models, applications and operations on the dataset (data mining techniques) and the seventh stage is analyzing the relationships to show the results and statistics as showing in the figure3

[17] Bharati, M. & Ramageri. (2010). "data mining technique applications," Indian Journal of Computer Science and Engineering, Vol. 1 No. 4, pp. 301-305.

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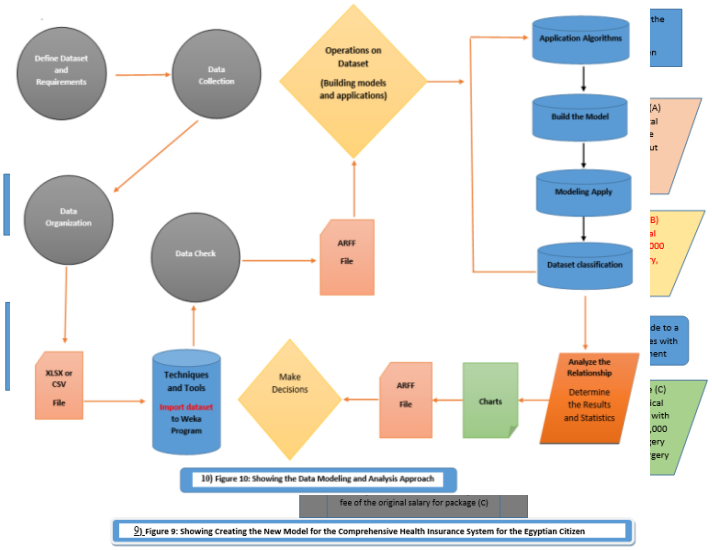


Figure3: Showing the Data Modeling and Analysis Approach

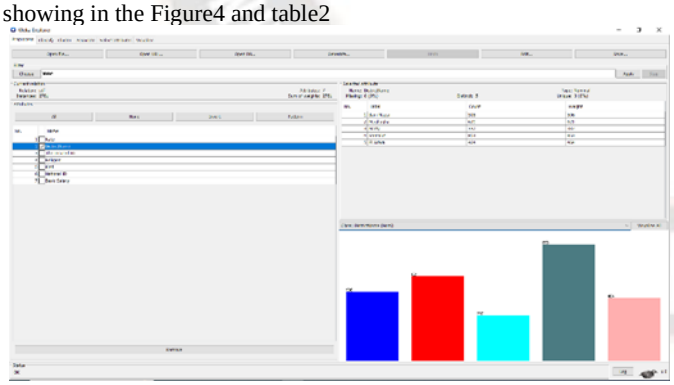
VII. Building Models, Applications and Operations on the Dataset

According to Weka classification for the dataset, the highest number of registered employees is 853 in Samalut by percentage 30.67%, Maghagha 621 employees by percentage 22.33%, Bani Mazar 506 employees by percent 18.19%, El Adwa 464 employees by percentage 16.68% then Matty 337 employees by percentage 12.12% in total 2781 employees as showing in Table1 and Figure4.

No	District Name	Count	Weight	Parentage
1	Bani Mazar	506	506	18.19%
2	Maghagha	621	621	22.33%
3	Matty	337	337	12.12%
4	Samalut	853	853	30.67%
5	El Adwa	464	464	16.68%
Total		2781	2781	100.00%

(Table1: Showing Number/Percentage of Employees are Categorized by Districts at Minya Governorate)

Based on Weka analytical tools, the employee's salary analysis as showing in the Figure4 and table2

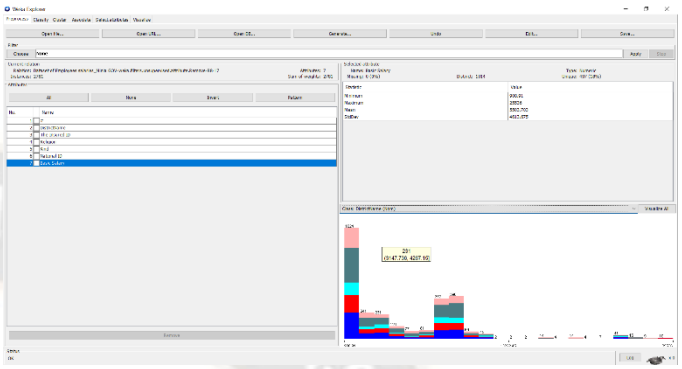


(Figure 4: Showing the Chart of Dataset are Categorized by Districts at Minya Governorate)

The minimum salary of the employees according to the sample is 928.91 L. E and the maximum salary of the employees is 25536 L.E, while the average of the employee salary values is 5503.70 L. E and the StdDev of the employee salary values is 4613.67 L. E as showing in table2 and Figure5.

Salaries Statistics	Value
Minimum	908.91 L.E
Maximum	25536 L.E
Mean	5503.70 L.E
StdDev	4613.67 L.E

(Table 2: Showing Employees' Salaries Analysis)



(Figure 5: Showing the Chart of Employees' Salaries Analysis)

A. *Create Model 1-A (Employees' Salaries/Pensions Classification and Subscriptions Fees Model)*

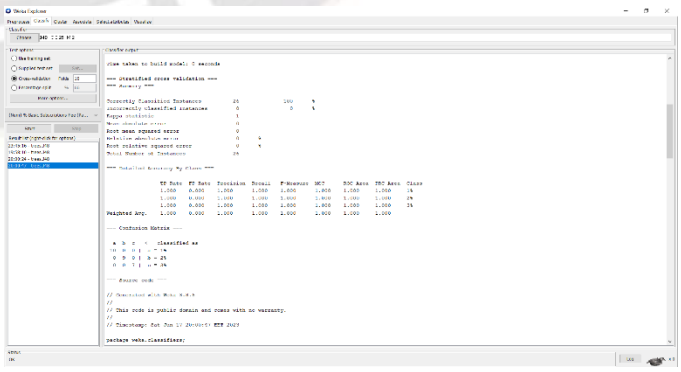
The mentioned model demonstrates a capability for learning and identifying various classifications of employees' salaries or pensions. This learning ability allows the model to adapt and apply its acquired knowledge to any large dataset. This capacity for learning and generalizing is a key characteristic of many machine learning and data modeling approaches. The scheme will use to create a model is classifiers and the algorithm will use is classifiers.trees.J48, and it is symbolized in Weka program by

(Scheme:weka.classifiers.misc.InputMappedClassifier -I -trim –W weka.classifiers.trees.J48 -- -C 0.25 -M 2)

Based on a new designed health insurance model was developed, the employees' salaries/pensions were classified into slices and where each slice contains a subscription fee that varies according to the type of slice as follows:

1) A slice (A): from 1 to 10,000 L.E he will pay 1% medical insure subscriptions fee of the original salary for package (C)
2) A slice (B): More than 10,001 L.E to 20. 000L.E he will pay 2% medical insure subscriptions fee of the original salary Package (C)
3) A slice (C): More than 20,001 L.E he will pay 3% medical insure subscriptions fee of the original salary for package (C)

The model of Employees' Salaries/Pensions Classification and the subscriptions fees is creation by using a number of 9 attributes and 26 instances, as Showing in figure6



(Figure6: Showing Scheme and Algorithm that used to Create the Employees' Salaries/Pensions Classification and Subscriptions Fees Model)

The below is showing the source code of employees' salaries/pensions classification and subscriptions fees model as follows: -

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```
=== Source code ===
// Generated with Weka 3.8.6
//
// This code is public domain and comes with no warranty.
//
// Timestamp: Sat Jun 17 20:00:47 EET 2023
package weka.classifiers;
import weka.core.Attribute;
import weka.core.Capabilities;
import weka.core.Capabilities.Capability;
import weka.core.Instance;
import weka.core.Instances;
import weka.core.RevisionUtils;
import weka.classifiers.Classifier;
import weka.classifiers.AbstractClassifier;
public class WekaWrapper
extends AbstractClassifier {
/**
* Returns only the toString() method.
*
* @return a string describing the classifier
*/
public String globalInfo() {
return toString();
}
/**
* Returns the capabilities of this classifier.
*
* @return the capabilities
*/
public Capabilities getCapabilities() {
weka.core.Capabilities result = new weka.core.Capabilities(this);
result.enable(weka.core.Capabilities.Capability.NOMINAL_ATTRIBUTES);
result.enable(weka.core.Capabilities.Capability.NUMERIC_ATTRIBUTES);
result.enable(weka.core.Capabilities.Capability.DATE_ATTRIBUTES);
result.enable(weka.core.Capabilities.Capability.MISSING_VALUES);
result.enable(weka.core.Capabilities.Capability.NOMINAL_CLASS);
result.enable(weka.core.Capabilities.Capability.MISSING_CLASS_VALUES);
result.setMinimumNumberInstances(0);
return result;
}
/**
* only checks the data against its capabilities.
*
* @param i the training data
*/
public void buildClassifier(Instances i) throws Exception {
// can classifier handle the data?
getCapabilities().testWithFail(i);
}
/**
* Classifies the given instance.
*
* @param i the instance to classify
* @return the classification result
*/
public double classifyInstance(Instance i) throws Exception {
Object[] s = new Object[i.numAttributes()];
for (int j = 0; j < s.length; j++) {
if (!i.isMissing(j)) {
if (i.attribute(j).isNominal())
s[j] = new String(i.stringValue(j));
else if (i.attribute(j).isNumeric())
s[j] = new Double(i.value(j));
}
}
// set class value to missing
s[i.classIndex()] = null;
return WekaClassifier.classify(s);
}
/**
* Returns the revision string.
*
* @return the revision
*/
public String getRevision() {
return RevisionUtils.extract("1.0");
}
/**
* Returns only the classnames and what classifier it is based on.
*
* @return a short description
*/
public String toString() {
return "Auto-generated classifier wrapper, based on weka.classifiers.trees.J48
(generated with Weka 3.8.6).\n" + this.getClass().getName() + "/WekaClassifier";
}
/**
* Runs the classfier from commandline.
*
* @param args the commandline arguments
*/
public static void main(String args[]) {
runClassifier(new WekaWrapper(), args);
}
}
class WekaClassifier {
public static double classify(Object[] i)
throws Exception {
double p = Double.NaN;
p = WekaClassifier.N7362487d2(i);
return p;
}
static double N7362487d2(Object []i) {
double p = Double.NaN;
if (i[7] == null) {
p = 0;
} else if (i[7].equals("A")) {
p = 0;
} else if (i[7].equals("B")) {
p = 1;
} else if (i[7].equals("C")) {
p = 2;
}
return p;
}
}
```

The below is showing the running model result of employees' salaries/pensions classification and subscriptions fees model as follows:-

```
=== Run information ===
Scheme:       weka.classifiers.trees.J48 -C 0.25 -M 2
Relation:     Dataset of Employees salaries Classification Model
Instances:    26
Attributes:   9
              #
              DistrictName
              The Insured ID
              Religion
              Kind
              National ID
              Basic Salary
              Class
              % Basic Subscriptions Fee (Package C)
Test mode:    10-fold cross-validation
=== Classifier model (full training set) ===
J48 pruned tree
------------------
Class = A: 1% (10.0)
Class = B: 2% (9.0)
Class = C: 3% (7.0)
Number of Leaves  :     3
Size of the tree :      4
Time taken to build model: 0 seconds
=== Stratified cross-validation ===
=== Summary ===
Correctly Classified Instances          26               100      %
Incorrectly Classified Instances         0                0      %
Kappa statistic                          1
Mean absolute error                      0
Root mean squared error                  0
Relative absolute error                  0      %
Root relative squared error              0      %
Total Number of Instances               26
=== Detailed Accuracy By Class ===
               TP Rate  FP Rate  Precision  Recall  F-Measure  MCC      ROC Area  PRC Area
Class
                 1.000    0.000    1.000      1.000   1.000      1.000    1.000     1.000     1%
                 1.000    0.000    1.000      1.000   1.000      1.000    1.000     1.000     2%
                 1.000    0.000    1.000      1.000   1.000      1.000    1.000     1.000     3%
Weighted Avg.    1.000    0.000    1.000      1.000   1.000      1.000    1.000     1.000
=== Confusion Matrix ===
 a  b  c   <-- classified as
10  0  0 |  a = 1%
 0  9  0 |  b = 2%
 0  0  7 |  c = 3%
```

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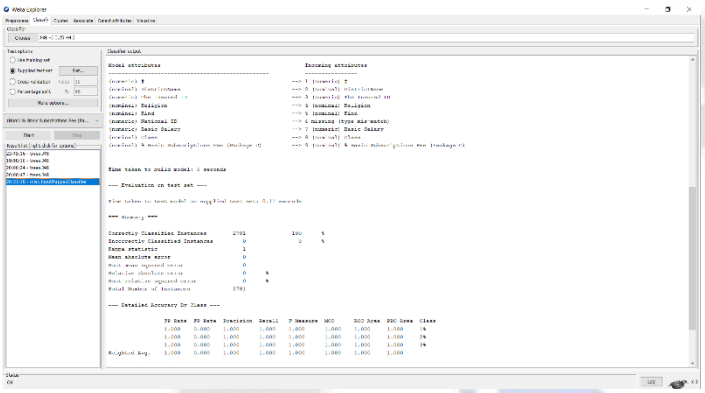
B. Modeling Application for Model 1-A

The classfiation of employees' salaries/pensions classification and subscriptions fees model that has been developed will apply on the dataset for 2781 instances to by using the classifiers scheme and classifiers.trees.J48 algorithm . it is symbolized in Weka program by

(Scheme:weka.classifiers.misc.InputMappedClassifier -I -trim -W weka.classifiers.trees.J48 -- -C 0.25 -M 2)

The model of employees' salaries/pensions classification and subscriptions fees applied on the dataset that contain 9 attributes and 2781 instances, as Showing in figure7



(Figure7: Employees' Salaries/Pensions Classification and Subscriptions Fees Model Applied on the Dataset

The below is showing the running model result of apply the employees' salaries/pensions classification and subscriptions fees model on the dataset as follows: -

=== Run information ===
Scheme: weka.classifiers.misc.InputMappedClassifier -I -trim -W weka.classifiers.trees.J48 -- -C 0.25 -M 2
Relation: Dataset of Employees salaries Classification Model
Instances: 26
Attributes: 9
#
DistrictName
The Insured ID
Religion
Kind
National ID
Basic Salary
Class
% Basic Subscriptions Fee (Package C)
Test mode: user supplied test set: size unknown (reading incrementally)
=== Classifier model (full training set) ===
InputMappedClassifier:
J48 pruned tree

Class = A: 1% (10.0)
Class = B: 2% (9.0)
Class = C: 3% (7.0)
Number of Leaves : 3
Size of the tree : 4

Attribute mappings:

Model attributes	Incoming attributes
(numeric) #	--> 1 (numeric) #
(nominal) District Name	--> 2 (nominal) DistrictName
(numeric) The Insured ID	--> 3 (numeric) The Insured ID
(nominal) Religion	--> 4 (nominal) Religion
(nominal) Kind	--> 5 (nominal) Kind
(numeric) National ID	--> 6 missing (type mis-match)
(numeric) Basic Salary	--> 7 (numeric) Basic Salary
(nominal) Class	--> 8 (nominal) Class
(nominal) % Basic Subscriptions Fee (Package C)	--> 9 (nominal) % Basic Subscriptions Fee (Package C)

Time taken to build model: 0 seconds
=== Evaluation on test set ===
Time taken to test model on supplied test set: 0.04 seconds
=== Summary ===

Correctly Classified Instances	2781	100 %
Incorrectly Classified Instances	0	0 %
Kappa statistic	1	
Mean absolute error	0	
Root mean squared error	0	
Relative absolute error	0	%
Root relative squared error	0	%
Total Number of Instances	2781	

=== Detailed Accuracy By Class ===

TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1%
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	2%
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	3%
Weighted Avg.	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000

=== Confusion Matrix ===

a	b	c	<-- classified as
2554	0	0	a = 1%
0	144	0	b = 2%
0	0	83	c = 3%

C. Create Model 1-B (Optional Medical Packages Model)

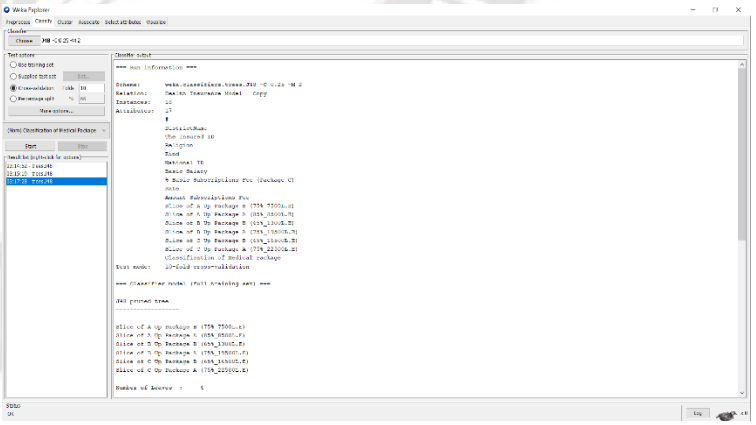
This model will be created to classify employees into medical packages based on their salaries or pensions classifications and subscription fees. This process involves leveraging the features and patterns learned from the dataset to make predictions about the most suitable medical packages for individual employees. the scheme and algorithm have been identified by Weka program. The scheme will use to create a model is classifiers and the algorithm will use is classifiers.trees.J48, and it is symbolized in Weka program by

(Scheme:weka.classifiers.misc.InputMappedClassifier -I -trim -W weka.classifiers.trees.J48 -- -C 0.25 -M 2)

Based on a new designed health insurance model was developed, a variety of different medical packages have been allocated for the insured to choose one of them as showing in table3:

Upgrade to Medical Packages	Percentage Subscriptions Fee	Amount Subscriptions Fee
Slice of A Up to Package B	75%	7500L.E
Slice of A Up to Package A	85%	8500L.E
Slice of B Up to Package B	65%	13000L.E
Slice of B Up to Package A	75%	19500L.E
Slice of C Up to Package B	65%	16500L.E
Slice of C Up to Package A	75%	22500L.E

(Table 3: Showing the Criteria for Upgrade to Medical Packages)



The model of optional medical packages is creation by using a number of 17 attributes and 18 instances, as Showing in figure8

(Figure8: Showing Optional Medical Packages Model 1-B)

The below is showing the source code of creation optional medical packages model1-B as follows: -

=== Source code ===
// Generated with Weka 3.8.6
//
// This code is public domain and comes with no warranty.
//
// Timestamp: Sat Jun 17 21:20:42 EET 2023
package weka.classifiers;

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```
import weka.core.Attribute;
import weka.core.Capabilities;
import weka.core.Capabilities.Capability;
import weka.core.Instance;
import weka.core.Instances;
import weka.core.RevisionUtils;
import weka.classifiers.Classifier;
import weka.classifiers.AbstractClassifier;
public class WekaWrapper
extends AbstractClassifier {
/**
* Returns only the toString() method.
* @return a string describing the classifier
*/
public String globalInfo() {
return toString();
}
/**
* Returns the capabilities of this classifier.
*
* @return the capabilities
*/
public Capabilities getCapabilities() {
weka.core.Capabilities result = new weka.core.Capabilities(this);
result.enable(weka.core.Capabilities.Capability.NOMINAL_ATTRIBUTES);
result.enable(weka.core.Capabilities.Capability.NUMERIC_ATTRIBUTES);
result.enable(weka.core.Capabilities.Capability.DATE_ATTRIBUTES);
result.enable(weka.core.Capabilities.Capability.MISSING_VALUES);
result.enable(weka.core.Capabilities.Capability.NOMINAL_CLASS);
result.enable(weka.core.Capabilities.Capability.MISSING_CLASS_VALUES);
result.setMinimumNumberInstances(0);
return result;
}
/**
* only checks the data against its capabilities.
*
* @param i the training data
*/
public void buildClassifier(Instances i) throws Exception {
// can classifier handle the data?
getCapabilities().testWithFail(i);
}
/**
* Classifies the given instance.
*
* @param i the instance to classify
* @return the classification result
*/
public double classifyInstance(Instance i) throws Exception {
Object[] s = new Object[i.numAttributes()];
for (int j = 0; j < s.length; j++) {
if (!i.isMissing(j)) {
if (i.attribute(j).isNominal())
s[j] = new String(i.stringValue(j));
else if (i.attribute(j).isNumeric())
s[j] = new Double(i.value(j));
}
}
// set class value to missing
s[i.classIndex()] = null;
return WekaClassifier.classify(s);
}
/**
* Returns the revision string.
*
* @return the revision
*/
public String getRevision() {
return RevisionUtils.extract("1.0");
}
/**
* Returns only the classnames and what classifier it is based on.
*
* @return a short description
*/
public String toString() {
return "Auto-generated classifier wrapper, based on weka.classifiers.trees.J48
(generated with Weka 3.8.6).\n" + this.getClass().getName() + "/WekaClassifier";
}
/**
* Runs the classfier from commandline.
*
* @param args the commandline arguments
*/
public static void main(String args[]) {
runClassifier(new WekaWrapper(), args);
}
class WekaClassifier {
public static double classify(Object[] i)
throws Exception {
double p = Double.NaN;
p = WekaClassifier.N41fe606e3(i);
return p;
}
static double N41fe606e3(Object []i) {
double p = Double.NaN;
if (i[6] == null) {
p = 0;
} else if (((Double) i[6]).doubleValue(A) <= 7500) {
p = 0;
} else if (((Double) i[6]).doubleValue(A) >= 8500) {
p = WekaClassifier.N7b572b664(i);
}
return p;
}
static double N41fe606e3(Object []i) {
double p = Double.NaN;
if (i[6] == null) {
p = 0;
} else if (((Double) i[6]).doubleValue(A) <= 8500) {
p = 0;
} else if (((Double) i[6]).doubleValue(A) >= 10000) {
p = WekaClassifier.N7b572b664(i);
}
return p;
}
static double N41fe606e3(Object []i) {
double p = Double.NaN;
if (i[6] == null) {
p = 0;
} else if (((Double) i[6]).doubleValue(B) <= 13000) {
p = 0;
} else if (((Double) i[6]).doubleValue(B) >= 19500) {
p = WekaClassifier.N7b572b664(i);
}
return p;
}
static double N41fe606e3(Object []i) {
double p = Double.NaN;
if (i[6] == null) {
p = 0;
} else if (((Double) i[6]).doubleValue(B) <= 19500) {
p = 0;
} else if (((Double) i[6]).doubleValue(B) >= 20000) {
p = WekaClassifier.N7b572b664(i);
}
static double N7b572b664(Object []i) {
double p = Double.NaN;
if (i[11] == null) {
p = 1;
} else if (i[11].equals("NO")) {
p = WekaClassifier.N54073d335(i);
} else if (i[11].equals("YES")) {
p = 1;
}
return p;
}
static double N54073d335(Object []i) {
double p = Double.NaN;
if (i[6] == null) {
p = 2;
} else if (((Double) i[6]).doubleValue(C) <= 16500) {
p = 2;
p = 1;
}
return p;
}
}
```

The below is showing the running model result of creation optional medical packages model as follows:-

```
=== Run information ===
Scheme:       weka.classifiers.trees.J48 -C 0.25 -M 2
Relation:     Health Insurance Model
Instances:    18
Attributes:   17
              #
              DistrictName
              The Insured ID
```

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Religion
Kind
National ID
Basic Salary
Rate
% Basic Subscriptions Fee (Package C)
Amount Subscriptions Fee
Slice of A Up Package B (75%_7500L.E)
Slice of A Up Package C (85%_8500L.E)
Slice of B Up Package B (65%_1300L.E)
Slice of B Up Package C (75%_19500L.E)
Slice of C Up Package B (65%_16500L.E)
Slice of C Up Package C (75%_22500L.E)
Other Option Medical Packages
Test mode: 10-fold cross-validation
=== Classifier model (full training set) ===
J48 pruned tree

Slice of A Up Package B (75%_7500L.E)
Slice of A Up Package C (85%_8500L.E)
Slice of B Up Package B (65%_1300L.E)
Slice of B Up Package C (75%_19500L.E)
Slice of C Up Package B (65%_16500L.E)
Slice of C Up Package C (75%_22500L.E)
Number of Leaves : 4
Size of the tree : 7
Time taken to build model: 0 seconds
=== Evaluation on test split ===
Time taken to test model on test split: 0 seconds
=== Summary ===

Correctly Classified Instances	18	100 %
Incorrectly Classified Instances	0	0 %
Kappa statistic	1	
Mean absolute error	0	
Root mean squared error	0	
Relative absolute error	0 %	
Root relative squared error	0 %	
Total Number of Instances	18	

=== Detailed Accuracy By Class ===

TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	A
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	B
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	C
Weighted Avg.	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000

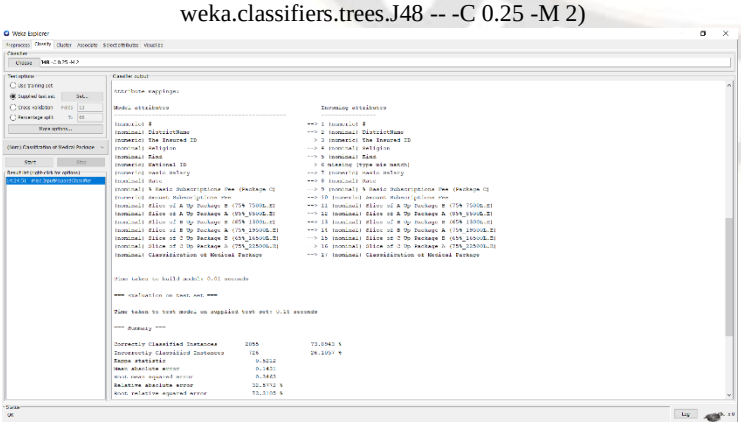
=== Confusion Matrix ===

a	b	c	<-- classified as
5	1	0	| a = C
0	0	4	| b = B
0	3	5	| c = A

D. Modeling Application for Model 1-B

The classfiation of optional medical packages model that has been developed to apply on the dataset for 2781 instances to by using the classifiers scheme and classifiers.trees.J48 algorithm as showing in figure9. it is symbolized in Weka program by

(Scheme:weka.classifiers.misc.InputMappedClassifier -I -trim -W weka.classifiers.trees.J48 -- -C 0.25 -M 2)



(Figure9: Showing Optional Medical Packages Model2 Applied on the Dataset)

The below is showing the running model result of creation optional medical packages model as follows: -

=== Run information ===
Scheme: weka.classifiers.misc.InputMappedClassifier -I -trim -W weka.classifiers.trees.J48 -- -C 0.25 -M 2
Relation: Model Employees salaries_Minia GOV
Instances: 18
Attributes: 17
#
DistrictName
The Insured ID
Religion
Kind
National ID
Basic Salary
Rate
% Basic Subscriptions Fee (Package C)
Amount Subscriptions Fee
Slice of A Up Package B (75%_7500L.E)
Slice of A Up Package A (85%_8500L.E)
Slice of B Up Package B (65%_1300L.E)
Slice of B Up Package A (75%_19500L.E)
Slice of C Up Package B (65%_16500L.E)
Slice of C Up Package A (75%_22500L.E)
Classification of Medical Package
Test mode: user supplied test set: size unknown (reading incrementally)
=== Classifier model (full training set) ===
InputMappedClassifier:
J48 pruned tree

Slice of A Up Package B (75%_7500L.E)
Slice of A Up Package A (85%_8500L.E)
Slice of B Up Package B (65%_1300L.E)
Slice of B Up Package A (75%_19500L.E)
Slice of C Up Package B (65%_16500L.E)
Slice of C Up Package A (75%_22500L.E)
Attribute mappings:

Model attributes	Incoming attributes
(numeric) #	--> 1 (numeric) #
(nominal) DistrictName	-> 2 (nominal) DistrictName
(numeric) The Insured ID	--> 3 (numeric) The Insured ID
(nominal) Religion	--> 4 (nominal) Religion
(nominal) Kind	--> 5 (nominal) Kind
(numeric) National ID	--> 6 missing (type mis-match)
(numeric) Basic Salary	--> 7 (numeric) Basic Salary
(nominal) Rate	--> 8 (nominal) Rate
(nominal) % Basic Subscriptions Fee (Package C)	--> 9 (nominal) % Basic Subscriptions Fee (Package C)
(numeric) Amount Subscriptions Fee	--> 10 (numeric) Amount Subscriptions Fee
(nominal) Slice of A Up Package B (75%_7500L.E)	--> 11 (nominal) Slice of A Up Package B (75%_7500L.E)
(nominal) Slice of A Up Package A (85%_8500L.E)	--> 12 (nominal) Slice of A Up Package A (85%_8500L.E)
(nominal) Slice of B Up Package B (65%_1300L.E)	--> 13 (nominal) Slice of B Up Package B (65%_1300L.E)
(nominal) Slice of B Up Package A (75%_19500L.E)	--> 14 (nominal) Slice of B Up Package A (75%_19500L.E)
(nominal) Slice of C Up Package B (65%_16500L.E)	--> 15 (nominal) Slice of C Up Package B (65%_16500L.E)
(nominal) Slice of C Up Package A (75%_22500L.E)	--> 16 (nominal) Slice of C Up Package A (75%_22500L.E)
(nominal) Classification of Medical Package	-> 17 (nominal) Classification of Medical Package

Time taken to build model: 0.01 seconds
=== Evaluation on test set ===
Time taken to test model on supplied test set: 0.17 seconds
=== Summary ===

Correctly Classified Instances	2055	73.8943 %
Incorrectly Classified Instances	726	26.1057 %
Kappa statistic	0.5212	
Mean absolute error	0.1431	
Root mean squared error	0.3463	
Relative absolute error	32.5772 %	
Root relative squared error	73.3105 %	
Total Number of Instances	2781	

=== Detailed Accuracy By Class ===

TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
0.915	0.000	1.000	0.915	0.955	0.885	0.957	0.971	C
0.115	0.024	0.558	0.115	0.191	0.182	0.977	0.875	A
0.852	0.278	0.312	0.852	0.457	0.403	0.878	0.581	B
Weighted Avg.	0.739	0.041	0.819	0.739	0.731	0.676	0.951	0.901

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```
=== Confusion Matrix ===
   a     b     c   <-- classified as
1683     0   157   |  a = C
   0    67   516   |  b = A
   0    53   305   |  c = B
```

VIII. Analyze the Relationships, Determine the Results and Statistics

A. *Relationships, Results and Statistics for Model 1-A*

It seems like you've presented the confusion matrix results for the predictions generated by the model applied to the dataset, specifically focusing on employees' salaries/pensions classifications and subscription fees. The confusion matrix provides insights into the model's performance by comparing predicted and actual classifications. Let's break down the information based on your description:

- **Slice (A):** Employees with salaries/pensions between1-10,000 L.E. Predicted: 2554 employees Percentage: 91.84%
- **Slice (B):** Employees with salaries/pensions between 10,001 – 20,000 L.E. Predicted: 144 employees Percentage: 5.18%
- **Slice (C):** Employees with salaries/pensions more than 20,000 L.E. Predicted: 83 employees Percentage: 2.98% as showing in figure 10

Confusion Matrix Results:

```
scss                                                    Copy code

                    Actual Classifications
                    ----------------------
                  |  Slice (A)  |  Slice (B)  |  Slice (C)  |
------------------|-------------|-------------|-------------|
Predicted Slice (A)  |    2554     |     144     |     83      |
------------------|-------------|-------------|-------------|
```

(Figure10: Confusion Matrix)

Interpretation:

- The majority of predictions (91.84%) fall into Slice (A), indicating that the model performs well in identifying employees with lower salaries or pensions.
- A smaller percentage (5.18%) of predictions fall into Slice (B), which represents employees with moderately higher salaries or pensions.
- The least number of predictions (2.98%) fall into Slice (C), indicating employees with the highest salaries or pensions as showing table4

The Salaries/Pensions Slices	S. Values	Count	Weight	Parentage	% Subscriptions Fees
Slice of (A)	1 - 10000	2554	2554	91.84%	1%
Slice of (B)	10.001 - 20.000	144	144	5.18%	2%
Slice of (C)	More than 20.001	83	83	2.98%	3%
Total		2781	2781	100.00%	

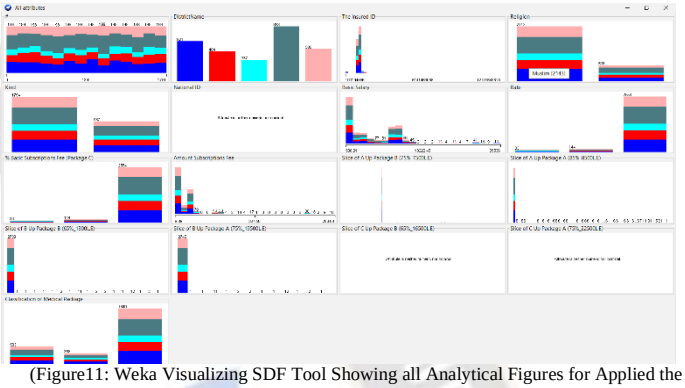
(Table 4: Showing the Predicting Distribution of Employees by New Health Insurance Slices and Subscriptions Fees Model)

And according to predicting of Weak analytical tools that it extracted from applied the employees' salaries/pensions classification and subscriptions fees Model on the dataset that Samalut district is the higher districts participants in the new health insurance by percentage 28.59 % in slice (A), Maghagha by percentage 20.42 %, Bani Mazar by percentage 16.58 %, El Adwa by percentage 15.25 % then Matty by percentage 11.00%, while slices (B) and (C) are less than 2% in all districts as showing in table 5.

District Name	Slice of (A)	Slice of (B)	Slice of (C)	Grand Total
Bani Mazar	16.58 %	1.08 %	0.54 %	18.19%
El Adwa	15.25 %	1.01 %	0.43 %	16.68 %
Maghagha	20.42 %	1.15 %	0.76 %	22.33 %
Matty	11.00 %	0.61 %	0.50 %	12.12 %
Samalut	28.59 %	1.33 %	0.76 %	30.67 %
Grand Total	**91.84 %**	**5.18 %**	**2.98 %**	**100.00 %**

(Table5: Showing the Predicting Distribution Percentages of Employees on New Health Insurance Slices Segregation by Districts)

The Weka visualizing SDF tool showing all figures that have been extracted form applied employees' salaries/pensions classification and subscriptions fees model on the dataset as showing in figure11



(Figure11: Weka Visualizing SDF Tool Showing all Analytical Figures for Applied the Employees' Salaries/Pensions Classification and Subscriptions Fees Model on the Dataset)

B. *Relationships, Results and Statistics for Model 1-B*

It seems like you're presenting the confusion matrix results for predictions generated by the optional medical packages model applied to the dataset. The confusion matrix provides insights into the model's performance in predicting the selection of medical packages by employees. Here's a breakdown based on your description:

Package (C): Basic Medical Packages Predicted: 1840 employees Percentage: 66%

Package (A): Higher Medical Packages Predicted: 583 employees Percentage: 21%

Package (B): Medium Medical Packages Predicted: 358 employees Percentage: 13% as showing in figure 12

Confusion Matrix Results:

```
mathematica                                             Copy code

                    Actual Medical Packages
                    -----------------------
                  |  Package (C)  |  Package (A)  |  Package (B)
------------------|---------------|---------------|--------------
Predicted Package (C)  |     1840      |      583      |     358
------------------|---------------|---------------|--------------
```

(Figure12: Confusion Matrix)

Interpretation:

- The majority of predictions (66%) fall into Package (C), indicating that the model performs well in identifying employees who select the basic medical packages.
- A significant portion of predictions (21%) falls into Package (A), representing employees who are predicted to select the higher medical packages.
- A smaller percentage of predictions (13%) falls into Package (B), indicating employees who are predicted to select the medium medical packages.

By using the analytics feature in ARFF file to determine how many employees are predict to be selected the medical package in each health insurance slice, where the insurance slices of (A) 1738 employees selected the basic medical package of (C) percentage 62.50%, 516 employees selected the higher medical package of (A) percentage

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18.55%, and 300 employees selected the medium medical package of (B) percentage 10.79%.

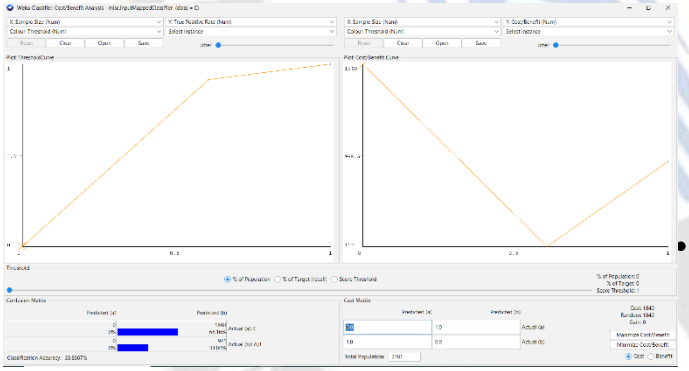
While the insurance slices of (B) 102 employees selected the basic medical package of (C) percentage 3.67%, 36 employees selected the higher medical package of (A) percentage 1.29%, and 6 employees selected the medium medical package of (B) percentage 0.22%.

While the insurance slices of (C) there is no employees selected the basic medical package of (C), 31 employees selected the higher medical package of (A) percentage 1.11%, and 52 employees selected the medium medical package of (B) percentage 1.87% as showing in table6

Count of Other Option Medical Packages	Basic Package	Other Optional Medical Packages		%
Insurance Slices	C	A	B	
Insurance Slices (A)	62.50%	18.55%	10.79%	91.84%
Insurance Slices (B)	3.67%	1.29%	0.22%	5.18%
Insurance Slices (C)	0.00%	1.11%	1.87%	2.98%
Grand Total	**66.16%**	**20.96%**	**12.87%**	**100%**

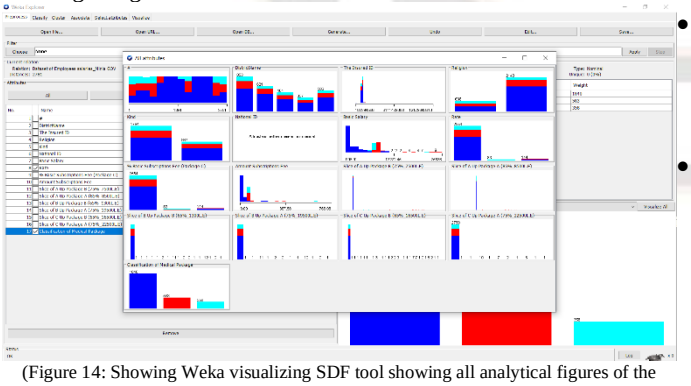
(Table6: Percentages of Employees are Predict to be Selected the Medical Package in Each Health Insurance Slice)

The visualizing SDF tool showing the chart of the prediction of employees who selected the medical package (C) compared with the employees who are predicted to choose the medical package of (A) and (B) as showing in figure13.



(Figure 13: SDF Tool Showing the Chart of the Prediction of Employees who are Selected Medical Package (C) Compared with Medical Package of (A) and (B))

The visualizing SDF tool showing all figures that have been extracted form appplied the option of medical package model on the dataset as showing in figure 14



(Figure 14: Showing Weka visualizing SDF tool showing all analytical figures of the Medical Package Model 1-B)

IX. Results and Recommendations

A. *The Results*

Based on the new model of the health insurance system which was applied by Weka version 3.8.6 program through classifiers scheme and classifiers. trees. J48 algorithm and it is symbolized in Weka program by (Scheme:weka.classifiers.misc.InputMappedClassifier -I -trim -W weka.classifiers.trees.J48 -- -C 0.25 -M 2)

These model has demonstrated proficiency by acquiring skills and learning characteristics applicable to large datasets. The obtained results from their application include the following:

6.1.1) The new health insurance model classifies health insurance slices into three categories, each with different subscription values based on the level of salaries/pensions received by employees.

6.1.2) In addition to the new classification, a set of new medical packages has been introduced. This includes the basic medical package, with a monthly subscription equal to the basic value under the new health insurance system, determined by the level of salaries/pensions.

6.1.3) Two additional higher-tier medical packages have been created, offering optional services. Each of these packages has higher monthly subscription fees and provides more extensive medical services.

6.1.4) The Weka program applied these two models to a dataset containing 2,781 employees. The employees were classified according to the new health insurance slices, and predictions were made regarding the distribution of employees across different medical packages.

6.1.5) Using the Weka models, the predicted numbers of employees selecting each medical package within each health insurance slice are as follows:

For insurance slice (A), 1,738 employees selected the basic medical package (C) with a monthly subscription of 45,219.71 L.E, 516 employees selected the higher medical package (A) with a subscription of 142,295.29 L.E, and 300 employees selected the medium medical package (B) with a subscription of 47,597.90 L.E, totaling 235,112.90 L.E.

- For insurance slice (B), 102 employees selected the basic medical package (C) with a subscription of 22,115.91 L.E, 36 employees selected the higher medical package (A) with a subscription of 24,965.08 L.E, and 6 employees selected the medium medical package (B) with a subscription of 2,464.30 L.E, totaling 49,545.29 L.E.
- For insurance slice (C), no employees selected the basic medical package (C), 31 employees selected the higher medical package (A) with a subscription of 36,965.91 L.E, and 52 employees selected the medium medical package (B) with a subscription of 44,374.81 L.E, totaling 81,340.72 L.E.
- According to the classification of new medical packages, the monthly subscription fees are 67,335.63 L.E for the basic medical package (C), 94,437.01 L.E for the basic medical package (B), and 204,226.27 L.E for the basic medical package (A). The total subscription fees for the new insurance slices amount to 365,998.91 L.E as showing in table7

Insurance Slices	Basic Package	Other Optional Medical Packages		Total Subscriptions Fees
	C	A	B	
A	45219.71 L.E	142295.29 L.E	47597.90 L.E	235112.90 L.E
B	22115.91 L.E	24965.08 L.E	2464.30 L.E	49545.29 L.E
C	0.00	36965.91 L.E	44374.81 L.E	81340.72 L.E
Total	**67335.63 L.E**	**204226.27 L.E**	**94437.01 L.E**	**365998.91 L.E**

(Table7: New Health Insurance Subscription Fees are Predict to Be Collect)

• According to the existing health insurance law in Egypt, the monthly subscription fee is a uniform 1% for all employees, without accounting for any other considerations. When comparing this to the new health insurance model developed on the same dataset of 2,781 employees,

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the total monthly subscription fees under the current health insurance system amount to 153,057.97 L.E. In contrast, the total subscription fees under the new health insurance model are 365,998.91 L.E.

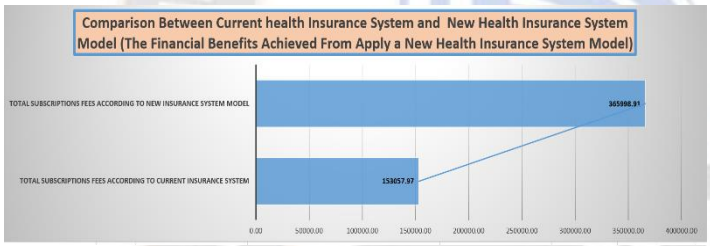
• The financial benefits realized from the new model amount to 212,940.94 L.E, representing a substantial increase of 139.12%. This notable improvement in financial benefits was revealed through the application of the new health insurance model, as detailed in Table 8.

Total of Insured	Total Monthly Subscriptions Fees According to Current Health Insurance System	Total Subscriptions Fees According to New Health Insurance System Model	Financial Benefits Achieved from a New Model	% of Benefits
2781	153057.97 L.E	365998.91 L.E	212940.94 L.E	139.12%

(Table 8: The Financial Benefits Achieved from Apply a New Health Insurance System Model)

B. The Recommendations

The researcher has effectively demonstrated the substantial financial benefits and overall effectiveness of the applied new health insurance system model when compared to the existing health insurance system. These benefits encompass a notable increase in the national income levels of the state. The enhanced financial resources generated through the new model offer promising opportunities to elevate the quality of services provided to citizens through health insurance. This increased funding facilitates the development of healthcare facilities, acquisition of advanced equipment, and ensuring the availability of essential medicines as showing in figure15.



(Figure 15: The Financial Benefits Achieved from Apply a New Health Insurance System Model)

Given the positive outcomes observed in the research, the researcher strongly recommends the implementation of this model in an initial experimental stage for a duration of one year. This experimental phase should be conducted in a selected sample of governorates in Egypt. The objective is to closely monitor the results and assess the privileges and advantages that can be obtained by applying this innovative health insurance system model. This approach allows for a controlled and phased implementation, enabling a thorough evaluation of the model's impact and benefits before potential broader adoption.

X. CONCLUSION

The comprehensive health insurance is considered one of the most important elements of the health system in Egypt, one of the significant outcomes that the researcher emphasizes from implementing the new model is the attainment of maximum benefits, whether in terms of individual medical services or the enhancement of the nation's overall income return. Under the existing health insurance law in Egypt, the monthly subscription fee is a flat 1% for all employees, without accounting for other factors. The results of applying the new model showed the effectiveness of the model through a comparison between the current subscription fees and the new health insurance model, developed using the same dataset of 2781 employees, reveals that the total monthly subscription fees under the current health insurance system amount to 153057.97 Egyptian Pounds (L.E.), whereas the total subscription fees under the new health insurance system model reach 365998.91 L.E., The financial benefits realized from the new model amount to 212940.94 L.E., representing a percentage increase of up to 139.12%. This demonstrates a considerable improvement in financial outcomes, and the potential advantages of transitioning to the new health insurance model.

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