Algorithm based on Decision Trees for the optimal choice of the Peruvian Pension System

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Abstract
This article details how fundamental pension insurance is, taking into account that there are two systems: The Private Pension System (AFP), in which the worker receives what he has received throughout the period he has worked, such as a personal savings account and the National Pension Insurance (ONP), which is a public body that allocates the money contributed by workers (common fund) and is disbursed as a concept of pensions to retirees. Taking into account the problem of the lack of information on Pension Insurance provided by both public and private entities, it was decided to build an algorithm for adequate information and thus achieve relevant decision-making for each worker who accesses the payroll for the first time or for those who decide to start independently,

Keywords: Decision tree, Private Pension System, National Pension System, active worker, unemployed worker, algorithm

1. Introduction

Often when a worker begins his working life within a company, he lacks knowledge or is not properly informed about which is the ideal option or which option generates a greater benefit when he has to decide on his pension insurance; therefore, it is designated according to the employer's criteria, thus generating future inconveniences; since wanting to modify pension insurance could be adverse for the worker, mainly when they want to carry out a modification of national insurance to private insurance (Gálvez, 2016; Guerrero, 2016; Soto, 2021).Just over 25% of Peruvians have insurance. However, many salaried and independent workers do not make regular contributions (Delgado, 2020; Sánchez, 2018). And a third of those who do have insurance will possibly obtain a pension lower than the vital minimum when the moment of their retirement arrives (Delgado, 2020; Sánchez, 2018). Moreover, every day there are more cases of elderly people who cannot live decently since the pension they obtain does not satisfy them even to cover their medications (Flores, 2021; Delgado, 2020; Sánchez, 2018).In fact, from what was previously stated, just over 25% of the Peruvian workforce is affiliated with the pension tax system (made up of two subsystems, SNP and SPP) (Cruzado de la Vega, 2021; Ramos and Román, 2021; Diaz, 2021). Of the affiliates in the SNP, it is calculated that 60% will not be considered to access a retirement pension (in other words, a regular monthly income during their old age) since they do not contribute in the amounts or for the periods minimums required by law (Cruzado de la Vega, 2021; Ramos and Román, 2021; Díaz, 2021).

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Of those affiliated with the SPP, approximately 60% have not collected the necessary savings to obtain a life annuity (Cruzado de la Vega, 2021; Ramos and Román, 2021; Díaz, 2021). Likewise, only 13.7% of the economically active Peruvian population (that is,

The Peruvian citizen who has contributed to both the SNP and the SPP has found himself oblivious to his fate in relation to the decisions to be made regarding his pension (Usca and Coaquira, 2021). Above the account statement reports (which do not require key information such as, for example, the estimate of the pension that the worker can aspire to) and the aggressive approaches of the sales forces, there has not been an active advisory and independent that you warn him of inappropriate decisions (Cáceres, 2021; Albarracín, 2021; Sanchez, 2021).

The objective of this article is to guarantee that people select the most appropriate Pension System regime in accordance with the situation of their condition as a worker accessing the payroll (Zorrilla, 2021). Consequently, it is being decided to develop an algorithm to appropriately choose Pension Insurance, as a solution to the lack of information of people who start their working life on the payroll, providing preliminary knowledge about the types of existing insurance, thus guide you for the proper choice of your pension insurance and thus prevent future economic difficulties (Vásquez, 2021). The results of this article will make it possible to verify the legitimacy and security of the application of the methodological framework, as well as the instruments used. Once the legitimacy, security of the methods have been ratified; The procedures, techniques, and instruments that were used in this research will allow them to be applied in other similar studies in which they seek to contribute to the field of development of Cognitive Systems (Ferrari, 2021).

2. Literature review

a) Algorithms

Macmillan, Vidal, Manglano, and Aragón (2021) pointed out that an algorithm is a series of instructions that indicate how to carry out a certain activity. Furthermore, an algorithm is a finite series of well-established rules in its control logic that enables the solution of a problem in a given period.

Palma (2021) pointed out that operating systems use algorithms in their participation procedures, memory management, virtual machine organization, or input and output devices management. To this end, programming languages would be meaningless if algorithms, for a reason, that it is precisely from algorithms that a programming language is functional and even more so the same procedure for translating a high-level programming language Machine language is supported by the algorithms that constitute the pieces of the translator or compiler software (Vidal et al., 2021).

According to the reference of Ríos, Vega, Vega, Hernández, and Martínez (2021) pointed out that requirements engineering, software architectures, management of a software project, and systems related to software quality are based on the development of their process in algorithms. In order to confer the corresponding discipline with the theoretical application, knowledge, and practice to the effectiveness and efficiency, reliable development of software systems that meet the requirements of customers and users (Argente, 2021; Vidal et al., 2021; Ríos et al., 2021).

b) Decision tree

Rodriguez, Montes, and López (2021) pointed out that a decision tree is a technique equivalent to dynamic programming, it is an appropriate method to describe and evaluate a set of investments made over time.

It is a hierarchical structure, which is made up of nodes where the information is stored, in which the nodes exchange the knowledge that will contribute to the system to learn, but where it not only uses the data already assigned but can carry out a self-learning, in which if a new question is reformulated. It is not defined in the nodes; it can issue an immediate response with preliminary knowledge (Rodriguez et al., 2021).

c) Pension System of Peru

According to Yeraldin (2021) pointed out that Peru's pension system is mixed, which has a national scope, participation in it is mandatory for those workers who belong to a dependency and is optional for those independent workers. The reform of the Peruvian pension system consisted of the construction of a personal capitalization system, whose operation goes simultaneously with the national pension system. Both regimes operate completely independently in legislation, management, and supervision.

d) National Pension System

Yeraldin (2021) points out that the national pension system is that pay-as-you-go system, which has as its most important feature the distribution of defined benefits (on non-fixed contributions) in convenient value so that the group contribution of workers can finance the pensions. This type of system is managed by the ONP.

Chipa and Mamani (2021) pointed out that for the national pension system, the contribution does not represent a private account but rather belongs to a community fund (pay-as-you-go system). Where the state is the one that determines a limit, minimum and maximum pension, and a contribution as a contribution.

e) Private Pension System

Vásquez, Huaman, and Ríos (2021) pointed out that it is that pension scheme based on personal savings. In opposition to the SNP scheme, in the SPP, the affiliates make contributions to an Individual Capitalization Account (CCI). This constitutes an intangible fund, the fund of which cannot be obtained by a different affiliate.

According to Díaz (2021), they pointed out that it is that system in which the member contributes a contribution to an individual account is managed by the Private Pension Fund Administrators (AFPs) in order to store a personal pension fund that finances their pension.

3. Methodology

This article seeks to guarantee that people select the most appropriate Pension System regime in accordance with their condition as a worker accessing the payroll. Taking into consideration that there is the problem of the lack of information on the Pension Insurance provided by the entities, consequently, it was decided to develop an algorithm that allows making relevant decisions for each worker who accesses the payroll for the first time. Or for those who decide to start independently. An applied investigation of the explanatory level was carried out, under an experimental type design, with Pretest - Posttest tests and control groups.

Table 1: Study variables

Type of variable	Description
Independent variable	Decision algorithm
Dependent variable	Pension insurance

The population consisted of 100 workers, of which the following age ranges were considered: 18 to 25 years, 26 to 35 years and 36 to 45 years in Metropolitan Lima, based on the number of populations identified with DNI by the National Registry of Identification and Civil Status in the year. The mentioned population is distributed as follows:

Table 2: Population

No. of workers	Age range
30	From 18 to 25 years
30	From 26 to 35 years old
40	From 36 to 45 years old

The design of an algorithm for the selection of a pension system that significantly contributes to the worker with the decision on the choice of pension insurance relevant for his future was proposed as a hypothesis. To estimate the independent variable (Decision algorithm), the survey data collection technique was used as an instrument and the questionnaire of an attitude scale with dichotomous responses, which exhibited a category of portability, security and usability; Similarly, for the dependent variable (Pension insurance), an attitude scale was used for the national pension system and the private pension system.

4. Preparation of proposal

a) Innovation idea

Next, the Canvas model is shown, which helps to distribute the idea of improvement regarding the choice of the most appropriate pension system for the worker who accesses the payroll for the first time. or for those who decide to start independently. A scheme was made to propose an algorithm for the selection of an adequate pension system, specifying the market segment aimed at young people between 21 and 45 years of age, and for personnel who start their working life on the payroll. The value proposals that are fundamental elements for the design of the proposal, the channels where the proposal will be executed, the relationship that it will maintain with the client, the sources of income that the algorithm will provide in the future as a mobile application, the key operations, the essential resources for the development of the proposal and the vital unions that will contribute to the success of the algorithm proposal for the choice of an adequate pension system.

b) Decision-making technique (Decision tree)

To carry out the development of this proposal, the decision tree was created with a view to the problem that people have today regarding the choice of an appropriate pension system, specifying in three fundamental items that a person should ask themselves, moments prior to your choice of a pension system relevant to your life.

The algorithm works based on a method called decision trees where it starts branching according to the added values, that is, gradually first entering the age, according to that, our process will only have two true or false alternatives. If the age is between 18 and 50 years old it is true and the algorithm begins its journey, otherwise the algorithm ends. The system will go through that branch (if it is true) with the following question if it is dependent; If you are a dependent and your salary is greater than 1200, it will apply for SPP, if it is not, it will apply for SNP and if you are not a dependent, the same procedure will apply. Then they will continue to walk the tree and they will be united in deciding whether the individual wants to aspire to earn more, If it is true, it will apply to the SPP, otherwise it will apply to the SNP, later we will have a question in relation to health, if you have a terminal illness it will apply to the SNP, otherwise it will apply to the SPP. Continuing with the tour, you will wonder if there is family independence which if it is true will lead you to a series of questions such as the number of people who depend on you (n) and the cost of maintenance (m) applying the following formula to obtain the total maintenance.

$$Maintenance = (salary - (n * m))$$

According to the result, if it is greater than 120, the individual will apply for SPP, if it is less than or equal it will apply for SNP. To finish the algorithm, it will add up all the scores where it will be defined which is the best option that suits the needs of the individual.

c) Application prototype

We can visualize how the test and the results behave in the following web link: http://www.ogosistudio.com/appeligebien/

5. Results

Next, we proceeded to simulate 5 different cases that are the most recurrent in our society in order to obtain information on which pension system would be the most suitable option for them.

First casuistry

In the first case, there is a graduate from a renowned university who wishes to retire at 65 and will work in an organization, receiving an estimated salary of S / 1000 at age 25, where after the algorithm requesting certain personal information can provide the most appropriate alternative for him.

Casuistic result 1: As can be seen, the algorithm provides the university graduate with the most appropriate alternative for him, for in this specific case, his option that best fits in accordance with his income, age, and the scenario is the ONP.

Second casuistry

In the second casuistry, there is a household staff, who receives remuneration of S / 930 at 35 years of age, which is the current minimum wage in Peru, where after the algorithm requests certain personal information, they will be able to provide a more appropriate alternative for him.

Casuistic result 2: As can be seen, the algorithm provides the domestic worker with the most appropriate alternative for him; for this specific case, his option that best suits his income, age, and the scenario is the ONP.

Third casuistry

In the third casuistry, there is a system engineer, who receives remuneration of S / 9000 at age 40, after having accessed the payroll for the first time after carrying out his activities in a FreeLancer way, where later than the algorithm prompts certain personal information will be able to provide with the most appropriate alternative for it.

Casuistic result 3: As can be seen, the algorithm provides the system engineer worker with the most appropriate alternative for him, which is specific; his option that best fits following his income, age, and the scenario is the AFP.

Fourth casuistry

In the fourth casuistry, there is a secondary school teacher who receives remuneration of S / 1200 at age 28, in addition, the teacher notifies that he will seek to apply for better positions with higher remuneration; where after the algorithm requests certain personal information, it can provide the most appropriate alternative for it.

Casuistic result 4: As can be seen, the algorithm provides the worker of the secondary school teaching profession with the most appropriate alternative for him, that for this specific case, his option that best adjusts following his income, age, and the scenario is the ONP.

Fifth casuistry

In the fourth casuistry, a disabled person working in a formal company receives remuneration of S / 930 at age 25, according to the disabled labor law; after the algorithm requests certain personal information, it can provide the most appropriate alternative for it.

Casuistic outcome 5: Tal As can be seen, the algorithm provides the worker with a disability with the most appropriate alternative for him that, for this specific case, his option that best fits in accordance with his income, age, and the scenario is the ONP.

6. Discussion

The algorithm based on the decision trees proposed has been developed to provide workers with the best option regarding decision-making regarding the choice of the pension system.

In relation to the results obtained, it is possible to show that an algorithm based on a decision tree allows workers, depending on their condition of entering the payroll for the first time or those who wish to contribute independently, to provide them through this tool the best choice of your pension system according to your considerations of income, age, health, maintenance, work history.

By applying this algorithm based on a decision tree, it enables workers to offer them the opportunity to guide them regarding the pension system that is most appropriate for them, since nowadays there are more and more cases of workers who have no idea about the pension scheme choose and are unaware of what decision to make, and there are even cases where workers had to conform to the employer's consideration. For this reason, this proposal is capable of not only saving you time on which pension scheme to follow but also providing you in detail with the best option for your financial future.

7. Conclusions

Every worker must access the payroll for the first time or decide to contribute independently, have a tool that allows selecting the most appropriate pension system for condition and this is what the proposed Algorithm based on Decision Trees will provide for the optimal choice of the Peruvian Pension System, the which through a series of questions about their age, income, work history, health will allow to automatically project the most appropriate alternative according to the worker's condition.

Likewise, this research will allow it to be applied in other similar large-scale studies, in which it seeks to contribute and complement the field of development of Cognitive Systems. Through the implementation of greater Machine Learning tools, they will promote the most suitable decision-making for workers, in which not only provides what would be the most convenient alternative, but also provides more details, reports and suggestions about the situation to future of the worker.

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