# Data Mining Framework for Nutrition Ranking

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## Abstract:

The goal of this research is to use the technology of Data Mining in a dataset for a ranking of three diets on the respondents and investigate such tools advantages and limitations such as large amount of manipulation before analysis replications with the same results from the analysis bias. Here we can see the ethical consequences of such programs in details.

**Keywords—Data Science, Nutrition Assessment, Clustering Analysis**

## Introduction

Dietary nutrition tool is basically a software framework for the assessment and evaluation of different respondent's nutrition status. There is a classified database which is attached to this tools in order to investigate the group class and intake meal species.(H. M. Alzoubi, Alshurideh, et al., 2021; Koroušić Seljak et al., 2013) The operator of such tools should firstly select the specific group in which the respondent belong to, such as infant, children, pregnant woman, adult, people with illness, afterwards the gender, height, weight and other general conditions and the intake food class such as different kind of dietary conditions such as the amount within a certain intake time are specified.(M. A. Afifi, n.d.; Al Kurdi, n.d.; Alhamad et al., 2021; Batayneh et al., 2021; Hamadneh & Alshurideh, n.d.; Khan et al., 2021) The ultimate goal of this tool is to nutrition assessment on the patient in caring hospital. Anyway the tool can be applied for the healthy persons in schools, hotels, restaurants and other places as a reference model to help and structure them for a good eating habit.(Ali et al., 2021; Ghazal, Hasan, et al., 2021; Matloob et al., 2021; Nunes et al., 2015) The aim of this article is to use the Dataset on the between 78 respondents on different Data Mining Algorithms.(M. A. M. Afifi et al., 2020; Bennett, 1992) We would like also to visualize the results through different clustering and modeling into Heat Map Matrix for the better evaluation of the algorithm and understanding of the dataset. Therefore, the ultimate goal in this research is to finding out the possibility of Input variables age, height and weight and gender to rank the three Diet types included in the Dataset.(Al Shebli et al., 2021; Ali et al., 2021; Alnuaimi et al., 2021; Alzoubi, Vij, et al., 2021; Alzoubi & Aziz, 2021; Ghazal et al., 2020; Naqvi Rabab and Soomro, 2021)

Data clustering is simply the process of organizing (clustering) data into several clusters for easy, efficient and most effective use. A properly designed clustering algorithm makes data available for business use, in other words, it makes the data easy to retrieve and analyze for modeling. After importing the Dataset file named Project 2 - stcp-Rdataset-Diet.csv the first

visual records the 78 instances and 7 attributes. At the first glance it seemed that the number of instances for our evaluation is quite small.

## DATASET DESCRIPTION

Since the Diet data analysis based on the ethical and subjective reasons behind the dietary status of the respondents it was more valuable to exactly watch the variable importance of the predictors of the analysis rather than just writing equations for gender, age or height and weight.(Alnazer et al., 2017; H. Alzoubi & Ahmed, 2019; H. M. Alzoubi et al., 2020) The following figure shows the distribution and some statistics on out raw dataset and we can see the normal distribution on the age, height and weight after 6 weeks.
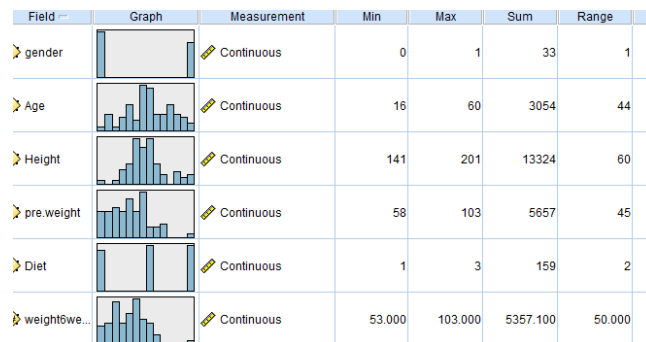
.



| Field | Graph | Measurement | Min | Max | Sum | Range |
|---|---|---|---|---|---|---|
| gender | | Continuous | 0 | 1 | 33 | 1 |
| Age | | Continuous | 16 | 60 | 3054 | 44 |
| Height | | Continuous | 141 | 201 | 13324 | 60 |
| pre.weight | | Continuous | 58 | 103 | 5657 | 45 |
| Diet | | Continuous | 1 | 3 | 159 | 2 |
| weight6we... | | Continuous | 53.000 | 103.000 | 5357.100 | 50.000 |

*Figure 1 - Statistical overview of the Raw Datasets*

Now it seems not only the number of the total respondents are enough but also the type and the size of the predictors and attributes are inefficient. It can be seen that there is a correlation between the pre-weight and weight after six weeks of diets. This can be seen on the next figure too. In our view it shouldn't be catastrophic about this since were experimenting the ethical and ranking phenomena behind dietary and not the statistics.
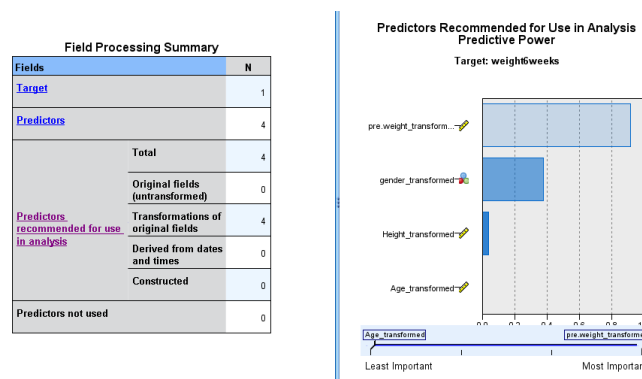


*Figure 2- predictive power of the Dataset*

Obviously the height, age and gender was not important attribute. We have reduced the attribute with a supervised clustering algorithms through different such as Kohonen, Two steps Cluster Node and K-Means where some of them resulted in different cluster number and size.

A Sihouette  Ranker clustering selection is used to evaluate the clustering efficiency of the algorithm. This algorithm has no automatic way of normalizing the data interpretation. Preprocessing of the data is therefore a very important step when doing data classification using SPSS Modeler.

| Use? | Graph | Model | | Build Time (mins) | Silhouette | Number of Clusters | Smallest Cluster (N) |
|---|---|---|---|---|---|---|---|
| ✓ | | | Two... | < 1 | 0.573 | 2 | 33 |
| ☐ | | | K-m... | < 1 | 0.484 | 5 | 2 |
| ☐ | | | Koh... | < 1 | 0.282 | 11 | 1 |

| Smallest Cluster (N) | Smallest Cluster (%) | Largest Cluster (N) | Largest Cluster (%) | Smallest/ Largest | Importance |
|---|---|---|---|---|---|
| 33 | 43 | 43 | 56 | 0.767 | 0.749 |
| 2 | 2 | 22 | 28 | 0.091 | 1.0 |
| 1 | 1 | 14 | 17 | 0.071 | 0.995 |

*Figure 3- Clustering Models used for Data Interpretation*

The predictor importance result of the first and second clustering namely, TwoStep and K-Means are representented in figure 4. As it can be seen the results are in goof quality of clustering.
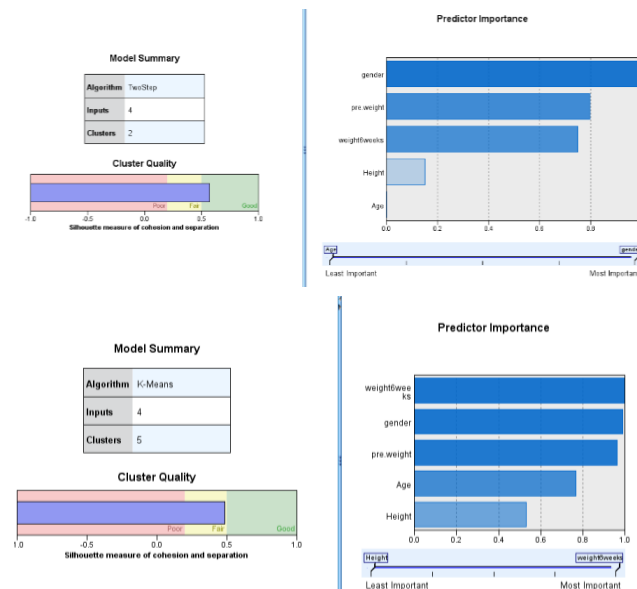


*Figure 4  - Graphical representation of clustering in accordance to the 6 weeks weight*
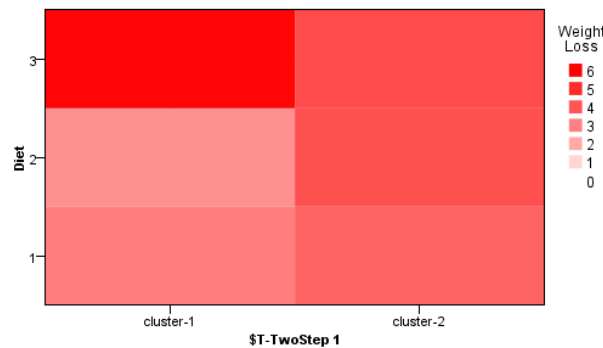
From the above results it is clear that in spite of better quality of the Two Step the K-Means clustering exhibits a better prediction power. In the two step method the Age and Height are not competent for the prediction. It should be furthermore noted that cluser 3 in K-Means are

outlier and can be excluded from other clusters. This result also confirm the K-Means can include the Age and Height into the model.

**DATA MODELING**

For the modeling of two clustering's, the derived node from the clustering 2 Steps imported to the dataset as a new filed. In addition to the variable diet type the new filed is also applied as splitting variable. Afterwards two variable height and age are excluded from the model and the Auto numeric node has been used to build 8 models. In the following figure the variable types are indicated . Furthermore, the difference between the Weight after 6 weeks and pre weight are calculated and created in the calculation. (The new created variable is called Weight Loss)(Bennett & Mangasarian, n.d.; Chapman et al., 2000)

| Model | Build Time (mins) | Correlation | No. Fields Used | Relative Error |
|---|---|---|---|---|
| KNN Algor... | < 1 | 0.591 | 2 | 0.67 |
| Neural Ne... | < 1 | 0.276 | 2 | 0.928 |
| Regressi... | < 1 | 0.160 | 2 | 0.975 |
| Generaliz... | < 1 | 0.160 | 2 | 0.975 |
| SVM 1 | < 1 | 0.072 | 2 | 0.998 |

| Field | Measurement | Values |
|---|---|---|
| gender | Flag | 1/0 |
| Age | Continuous | [16,60] |
| Height | Continuous | [141,201] |
| pre.weight | Continuous | [58,103] |
| Diet | Nominal | 1,2,3 |
| weight6weeks | Continuous | [53.0,103.0] |
| $T-TwoStep 1 | Nominal | cluster-1,c... |
| Weight Loss | Continuous | [-2.100000... |
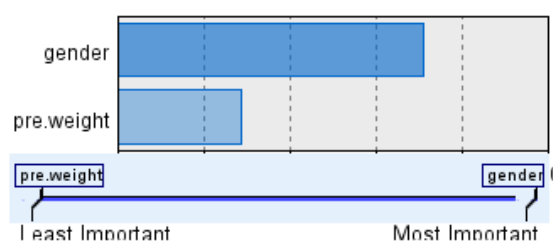
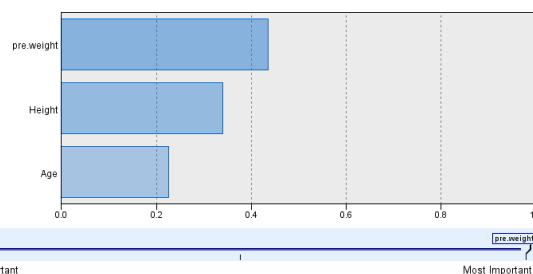*Figure 5- Results of estimation with twosteps clustering of weight Loss*

## RESULTS

Results and error rates for the build model are shown. Accordingly, the Diet three is better than 2 and 1 in all clusters but it is still difficult to generalize this between diet 1 and 2. Since the relative error is high, and only gender is considered and still age and height were excluded this model is not efficient. Finally yet importantly, the effect of gender on this model outperforms the pre.weight variable.

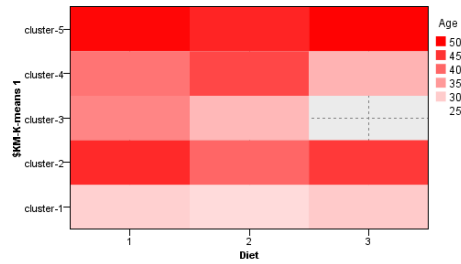It is therefore important to test the other clustering.
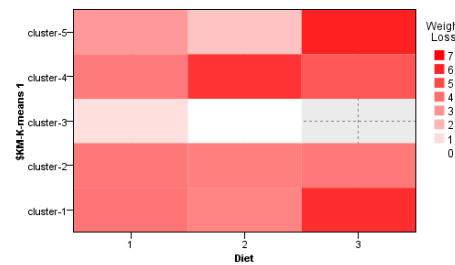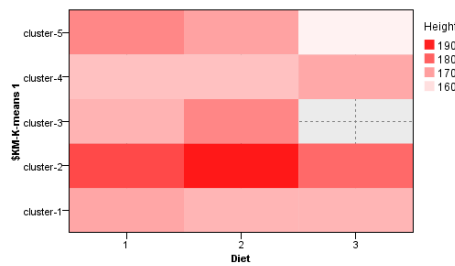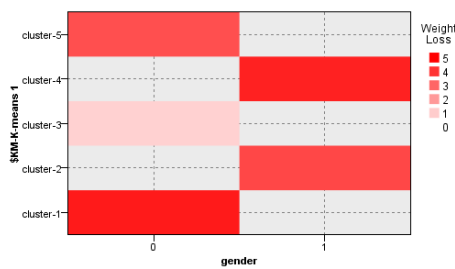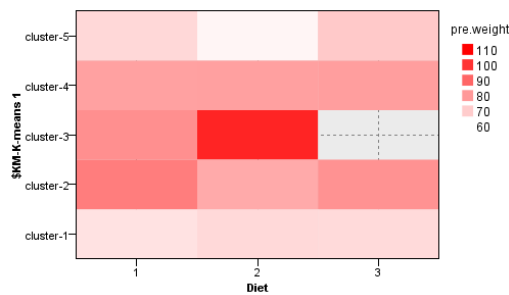
*Figure 6 - Results of estimation with K-Means clustering of weight Loss*

In spite of problem for the clustering with variable age, preweight and height can be distinguished from the above graph. It is also notable to check the comparison between diet 2 and 1 are clearer. However, the diet 3 outperform the other one with a good distance.

## SPSS Modeller Bivariate Analysis)
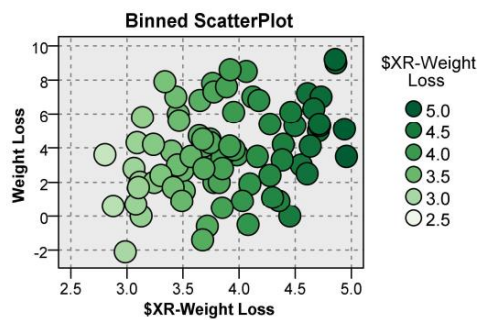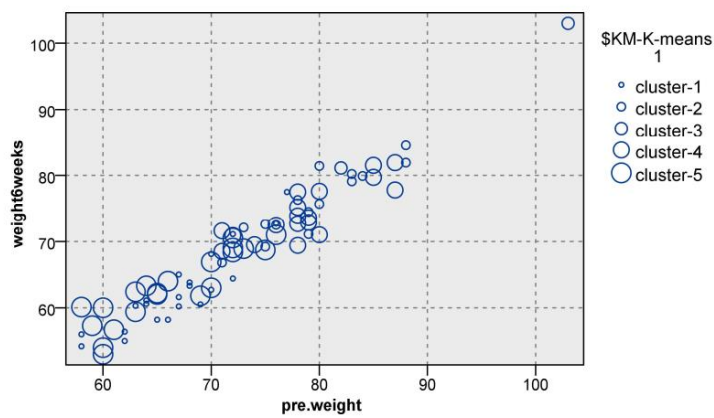




Results for output field Weight Loss Overall Results Comparing $ E-Weight Loss with Weight Loss

| Minimum Error | -4.906 |
|---|---|
| Maximum Error | 5.704 |
| Mean Error | -0.0 |
| Mean Absolute Error | 1.809 |

| Standard Deviation | 2.306 |
|---|---|
| Linear Correlation | 0.428 |
| Occurrences | 78 |

Output field Weight Loss, splitting by field Diet = 1

| Minimum Error | -3.829 |
|---|---|
| Maximum Error | 5.704 |
| Mean Error | 0.0 |
| Mean Absolute Error | 1.597 |
| Standard Deviation | 2.191 |
| Linear Correlation | 0.209 |
| Occurrences | 24 |

Comparing $ E-Weight Loss with Weight Diet = 2

| Minimum Error | -4.906 |
|---|---|
| Maximum Error | 4.236 |
| Mean Error | 0.0 |
| Mean Absolute Error | 2.011 |
| Standard Deviation | 2.499 |
| Linear Correlation | 0.14 |
| Occurrences | 27 |

Diet = 3 Comparing $ E-Weight Loss with Weight Loss

| Minimum Error | -4.231 |
|---|---|
| Maximum Error | 4.339 |
| Mean Error | -0.0 |
| Mean Absolute Error | 1.796 |
| Standard Deviation | 2.293 |

Analysis **Standard Deviation** 2.293

| Linear Correlation | 0.289 |
|---|---|
| Occurrences | 27 |

Analysis Number of clusters: 5

| Iteration | Error |
|---|---|
| 1 | 0.247 |
| 2 | 0.134 |
| 3 | 0.116 |
| 4 | 0.024 |
| 5 | 0.037 |
| 6 | 0.048 |
| 7 | 0.027 |
| 8 | 0.0 |

## DISCUSSION

To ensure the quality of documenting the results, CRISP-DM (CRoss-Industry Standard Process for Data Mining (CRISP-DM) methodology) has been used in this report to analysis the data. The whole processes of CRISP-DM are Data understanding, Data preparation, Modeling, Evaluation and Deployment.(Alshurideh et al., 2020; H. Alzoubi et al., 2020; Jevons et al., 2010; Rehman et al., 2021)

As mentioned strategical reflections and giving the solution for the nutrition evaluation tool is the subject of this research. We have experienced on vast methods of data mining for the dietary dataset to answer the questions of research. Are there any main factors effecting the quality of the information out of the 87 attributes? We have deduced from the results and finding and comparing the pair of data that supposed to have effect on the weight Loss but still some points and comparison remain unclear such as age and height. Most models confirm the pre weight as an explanatory variable for the ranking of the dietary nutrition.(H. M. Alzoubi & Yanamandra, 2020; Dr. Deepak Kalra Dr. Mohammed A. M. Afifi, 2020; Joghee et al., n.d.; Mehmood & Al-Gasaymeh, 2019; Sahi et al., 2017; Vallaster & von Wallpach, 2013)

We have searched the Internet and see the reflection of our work from the websites of some nutrition tools developed for the improvement of the eating habit. The ultimate goal of this tool is to nutrition assessment on the patient in caring hospital. Anyway the tool can be applied for the healthy persons in schools, hotels, restaurants and other places as a reference model to help and structure them for a good eating habit.(Ghazal et al., 2013; Ghazal, Alshurideh, et al., 2021; Ghazal, Said, et al., 2021; Hasan et al., 2021)

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