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# Transmogrified Imputation Algorithm for Clustering Data in Missing Data Imputation

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**Abstract:** This research article proposes to implement transmogrification process in the Imputation procedures to overcome the challenges in missing values. Appropriate data pre-processing methods and clustering mechanisms in data mining plays significant role to ensure good quality of data. The data pre-processing tasks include identification of outliers, smoothing noisy data and overcoming inconsistent data. Issues related to data incompleteness, still remains a challenge to many researchers. The transmogrified method uses mathematical approach and cluster based Imputation Algorithm for missing data imputation. The IBM Log data set and Sonar data set were used to demonstrate the performance of the proposed method. The proposed algorithm is evaluated by extensive experiments and comparison with KNNI - Imputation with K-Nearest Neighbor, MSC- Imputation with Mean-shift Clustering, AHC- Agglomerative Hierarchical clustering, EM-GMM- Expectation – Maximization Clustering using Gaussian Mixture Models and Naïve Bayesian Model. The results showed that the proposed algorithm has better performance than the existing imputation algorithms in terms of classification accuracy.

**Keywords:** KNNI - Imputation with K-Nearest Neighbor, MSC- Imputation with Mean-shift Clustering, AHC- Agglomerative Hierarchical clustering, EM-GMM- Expectation – Maximization Clustering using Gaussian Mixture Models and Naïve Bayesian Model

## I. INTRODUCTION

Missing values has long been an unavoidable problem that occurs to almost data-driven solutions. There are various causes such as incomplete data collection, data entry errors, incompetent data acquisition from experiments, and unfinished responses to a questionnaire [1]. This raises a significant problem towards data analysis, especially to those learning Models that are compatible only with a complete data set. Over the past decades, Provision of innovative research aiming to fill in missing vales is continuously developed [2]. A rich collection of data pre-processing techniques has been made available, including zero imputation, average imputation, minimum imputation, maximum imputation, expectation maximization, linear regression imputation and k-nearest neighbours. Unlike the conventional approach that excludes any record with missing values, the aforementioned statistical and machine learning methods attempt to predict those with the values close to the original data. In this research the following supervised and unsupervised learning algorithms are compared with the proposed algorithm.

## II. LITERATURE REVIEW

Past Literature pertaining to Missing data imputation techniques to compute the missing value for the missing record or attribute and fill the estimated value from other reported values were surveyed. In review of literature Missing data imputation techniques are classified as ignorable missing data imputation and non-ignorable missing data imputation. In the literature many researchers have proposed missing data imputation techniques such as Cold-Deck Imputation, Imputation with K-Nearest Neighbor, K-means Clustering Imputation, Imputation with Fuzzy K-Means Clustering, imputation with Agglomerative Hierarchical clustering, Imputation with Mean-shift Clustering, Naïve Bayesian Imputation, Bolzano–Weierstrass Classifier Imputation and Expectation – Maximization Clustering using Gaussian Mixture Models Algorithm. Little and Rubin summarize the mechanism of imputation method. Also introduces mean imputation method to find out missing values. The drawbacks of mean imputation are sample size is overestimated, variance is underestimated, correlation is negatively biased. For median and standard deviation also replacing all missing records with a single value will deflate the variance and artificially inflate the significance of any statistical tests based on it. Different types of machine learning techniques are supervised and unsupervised machine learning techniques summarized. Classification of multiple imputation and experimental analysis are described. Min Pan et al. summarize the new concept of machine learning techniques like NBI also analysis the experimental results which impute missing values. Comparisons of different unsupervised machine learning technique are referred from survey paper. To overcome the unsupervised problem Peng

Liu, Lei Lei et al. applied the supervised machine learning techniques called Naïve Bayesian Classifier. In the data mining context, machine learning technique is generally classified as supervised and unsupervised learning technique both belong to machine learning technique. Supervised classification focus on the prediction based on known properties and the classification of unsupervised focus on commonly used classification algorithm known as Naïve Bayesian imputation techniques.

Mean Imputation is the process of replacing the missing data from the available data where the instance with missing attribute belongs. Median Imputation is calculated by grouping up of data and finding average for the data. Median can be calculated by finding difference between upper and lower class boundaries of median class. Standard Deviation calculate the scatter data concerning the mean value. It can be convenient in estimating the set of fact which can possess the identical aim but a different domain. Estimate standard deviation based on sample and entire population data. Another way of learning technique is classified as supervised learning that focus on the prediction based on known properties.

Naïve Bayes technique is one of the most useful machine learning techniques based on computing probabilities. It analyses relationship between each independent variable and the dependent variable to derive a conditional probability for each relationship. A prediction is made by combining the effects of the independent variables on the dependent variable which is the outcome that is predicted. It requires only one pass through the training set to generate a classification model, which makes it very efficient. The Naïve Bayesian generates data model which consists of set of conditional probabilities, and works only with discrete data.

### III. METHODOLOGY

In this article Transmogrification of Imputation Algorithm for Clustering of Data is dealt with novel for missing data imputation, the transmogrified method uses mathematical approach and Index segmentation based Imputation Algorithm for missing data imputation. The databases were used to demonstrate the performance of the proposed method. The proposed algorithm is evaluated by extensive experiments and comparison with KNNI - Imputation with K-Nearest Neighbor, MSC- Imputation with Mean-shift Clustering, AHC- Agglomerative Hierarchical clustering, EM-GMM- Expectation – Maximization Clustering using Gaussian Mixture Models and Naïve Bayesian Model. An imputation strategy Transmogrified approach is described to compute the proximity measure in the feature missing space between the missing data to identify the nearest neighbor missing data from where the values are to be imputed.

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Input: dataset with Clustered missing values in the set U.
T=Set of all observed transaction ID's, S required data

Output: Imputed missing data P
Scan the transaction data base DB once Divide the DS into M segments
Collect F, the set of Frequent Items & support of each FI

Step 1: Select the missing dataset record S from the set M and impute missing values
Step 2: Impute missing values based on proximity measures with all the members of U
Do begin
Set P to be Empty
Create the root of the FI, were T with null
While If no response from user
Do begin
Fetch the next incoming transaction (T) From dataset
Step 3: for each
Frequent 2-data X in F
do beginning
For each
Segment S in the dataset Do begin
Aggregate the count of each set of X with in sum of counts respectively;
End for each
End for each
Step 4: let the sorted FI list in transaction be [p | P], P-remaining list, p-first element
For each
Combination (denoted β) of the nodes in P do End for each
Step 5: for (i in T)
Process the dataset (Ui, Ui, ts, Uiavg, [Si])
If (exist (l Si)) Output i;
End if;
Ui* required data size (Uiavg, Ø) Insert element (e,U)
Continue for delete element (U) For every split of U into U=U0:U1;
Insert element (item i, list U)
Create a new segment V with content i and capacity l
U u f { v } (ie., add i to the head U) Output t; Compress segments (U);
Delete element (List U);
Remove a segment from tail of list U Update element (List U);

Step 6: Train the dataset into training (TRr) and testing (Tr) sets,
Step 7: for each r
i) Build Clustering set using the records obtained from Tr;
ii) Compute the probabilities using the test dataset TRr;
iii) Identify and collect the actual decision result TRr;

Step 8: stop;

```

Transmogrified Imputation Algorithm for clustering data in Missing Data Imputation



#### IV. EVALUATION AND RESULTS

In this section we present the experimental evaluation for a Transmogrified Imputation Algorithm (TIA) for clustering data in Missing Data Imputation using IBM Log data set and Sonar data set. The table below reveals the test accuracies of Transmogrified clusters obtained through TIA and normal clusters. The Transmogrified Imputation Algorithm TIA is compared with other algorithms with KNNI - Imputation with K-Nearest Neighbor, MSC- Imputation with Mean-shift Clustering, AHC- Agglomerative Hierarchical clustering, EM-GMM- Expectation – Maximization Clustering using Gaussian Mixture Models and Naïve Bayesian Model.

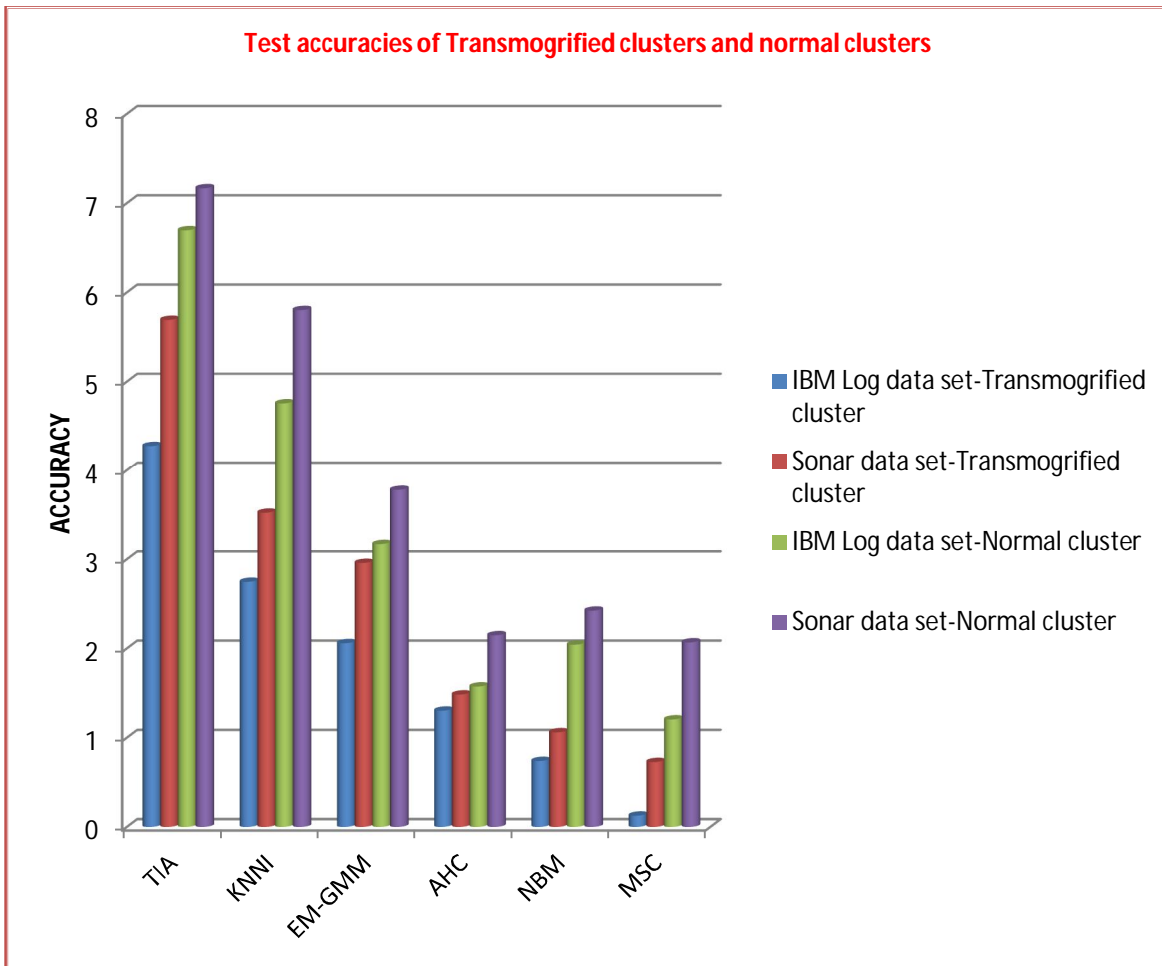
| Datasets         | Records | Attributes |
|------------------|---------|------------|
| IBM Log data set | 56865   | 182        |
| Sonar data set   | 32578   | 45         |

Datasets Used For the Experiment

| Dataset                                 | TIA      | KNNI      | EM-GMM   | AHC       | NBM       | MSC      |
|---|----------|-----------|----------|-----------|-----------|----------|
| IBM Log data set-Normal cluster         | 4.276185 | 2.7464234 | 2.058584 | 1.3027783 | 0.7388564 | 0.126606 |
| Sonar data set-Normal cluster           | 5.691732 | 3.5210146 | 2.957915 | 1.4831539 | 1.06036   | 0.726867 |
| IBM Log data set-Transmogrified cluster | 6.696001 | 4.7558449 | 3.169164 | 1.5732506 | 2.042097  | 1.204268 |
| Sonar data set-Transmogrified cluster   | 7.166716 | 5.8019504 | 3.778248 | 2.1474655 | 2.423084  | 2.067616 |

Table showing the Test accuracies of Transmogrified clusters and normal clusters

The chart below clearly depicts that Transmogrified Imputation Algorithm (TIA) for clustering data in missing data imputation using IBM Log data set and Sonar data set yields more test accuracies when compared to KNNI - Imputation with K-Nearest Neighbor, MSC- Imputation with Mean-shift Clustering, AHC- Agglomerative Hierarchical clustering, EM-GMM- Expectation – Maximization Clustering using Gaussian Mixture Models and Naïve Bayesian Model.



Test Accuracies of Transmogrified Clusters and Normal Clusters using IBM Log data set and Sonar Data set

## V. CONCLUSION

In this article, Transmogrified Imputation Algorithm for Clustering of Data in Missing Data (TIA) is described. It is an Improved novel Clustering Algorithm where Transmogrification of Data based Imputation Algorithm of missing values is discussed, that aims to improve in terms of accuracy. The test accuracies of TIA were compared with KNNI - Imputation with K-Nearest Neighbor, MSC- Imputation with Mean-shift Clustering, AHC- Agglomerative Hierarchical clustering, EM-GMM- Expectation – Maximization Clustering using Gaussian Mixture Models and Naïve Bayesian Model using two different data sets IBM Log file data set and Sonar data set. We conclude that the use of our Transmogrified Imputation Algorithm for Clustering of Data in Missing Data improved the accuracies of the predictions on real world missing data value problems.

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