**JOURNAL ARTICLE EVALUATION OUTLINE**

TITLE: Artificial Neural Network and Latent Semantic Analysis for Adverse Drug Reaction Detection

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# INTRODUCTION

The title suggests that the research paper focuses on the development and application of artificial neural networks (ANNs) and latent semantic analysis (LSA) for the purpose of detecting adverse drug reactions (ADRs). Since it’s a study using these methods, it indicates a **descriptive study** because the study focuses on proposing a method using LSA with ANN for ADR detection and the title suggests the utilization of specific techniques for ADR detection rather than establishing causal relationships or correlations, aligning with a descriptive study design.

The title "Artificial Neural Network and Latent Semantic Analysis for Adverse Drug Reaction Detection," the terms "Artificial Neural Network" and "Latent Semantic Analysis" refer to the methodologies or techniques being used for the research. These are not explicitly independent or dependent variables themselves.

However, the phrase "**Adverse Drug Reaction Detection**" suggests the overarching theme or outcome of the study, which could be considered the **dependent variable**. Adverse drug reactions are the phenomena being detected or identified by the methods described in the paper.

The **independent variables**, on the other hand, are not explicitly mentioned in the title. These would typically include various factors or features used as input to the artificial neural network and latent semantic analysis models, such as **drug characteristics, patient demographics, and textual data** related to adverse drug reactions.

To pinpoint where information about the statistical tools used in the research paper it’s under the **Research methodology** section with the topic **Latent semantic analysis** which consists of SVD that is **Singular Value Decomposition** which is used as a **statistical tool for dimensionality reduction** in the context of LSA. In the context of adverse drug reaction detection, SVD helps extract relevant features from textual data describing drug profiles, patient characteristics, and adverse reactions. These features can then be used as input variables in ANN models for classification and prediction tasks.

# ANALYZING THE VARIABLES.

# INDEPENDENT VARIABLES.

# The independent variables are textual data for adverse drug reaction detection and the parameters of the artificial neural network (ANN) and latent semantic analysis (LSA) algorithms. This could include free-text descriptions of adverse events reported in medical records or pharmacovigilance databases and these parameters could involve the architecture of the ANN (number of layers, neurons per layer, activation functions) and LSA (dimensionality reduction techniques, threshold values).

# Features extracted from drug data may encompass attributes such as drug names, dosage, administration route, and chemical properties and patient-related variables could involve patient demographics (age, gender), medical history, concurrent medications, and genetic factors. These may possibly be independent variables.

# The Nature of measurements for Textual data for adverse drug reaction detection would be treated as nominal or ordinal measurements while for these parameters are typically continuous and can include aspects like learning rates, weights, and biases in the ANN, and latent semantic dimensions in LSA.

# DEPENDENT VARIABLES.

The **dependent variable(s)** in this research paper is the occurrence or **presence of** adverse drug reactions (**ADRs**) in the dataset. ADRs are typically **binary** variables, where each observation is classified as either having an adverse drug reaction or not having one. Since ADRs are binary outcomes (occurring or not occurring), the **nature of the measurements is categorical**.

Detection accuracy might be a key dependent variable that measures how accurately the ANN and LSA models can identify adverse drug reactions from the given data and Sensitivity and specificity are common metrics used to evaluate the performance of binary classification models like those employed in ADR detection. Sensitivity measures the proportion of true positives identified by the model, while specificity measures the proportion of true negatives. F-Measure are additional performance metrics that provides insights about the model's performance.

# HYPOTHESES.

While the paper outlines the methodology and approach for ADR detection using ANNs and LSA, it does not explicitly state specific hypotheses to be tested. Instead of hypotheses, the paper presents the research problem and the proposed solution using ANNs and LSA techniques. The focus is on developing and evaluating the predictive model rather than testing specific hypotheses.

This could have been the Hypothesis:

**Null Hypothesis (H0):** There is **no significant difference** in the effectiveness of adverse drug reaction (ADR) detection between artificial neural networks (ANNs) and traditional methods.

**Alternative Hypothesis (H1):** ANNs combined with latent semantic analysis (LSA) result in **significantly higher accuracy** in ADR detection compared to traditional methods.

Based on the information provided, there is **no mention** of a specific **alpha risk level** for rejecting the null hypothesis in fact they’ve provided the **learning rate** which is a hyperparameter that controls the step size at which the model's parameters are updated during training and its value is **0.01**.

Since the authors did not specify an alpha risk level, we can make an inference based on common practices in scientific research. In many studies, including those involving machine learning and data analysis, an **alpha level of 0.05** is commonly used as a threshold for statistical significance. This means that if the p-value obtained from hypothesis testing is **less than 0.05**, the null hypothesis is rejected, and the results are considered statistically significant.

# D. SAMPLE.

The sample consists of **2500** reviews in the dataset utilized for this study and **945** sentences in the texts extracted from Twitter and also There are **982** ADRs in total among all texts. Personally, I feel the sample **wasn't large enough** in order to cover all kinds of people and their reaction towards the drugs which plays a crucial role in accuracy of model for large set of datasets providing correct results for most of the test cases.

To compute the standard error of the mean, we would need the sample size (N) and the standard deviation of the data. While the information provided includes the sample size (2500 reviews), **it does** **not specify the standard deviation**. Without the standard deviation, it's not possible to compute the standard error of the mean.

The critical region for rejection of the null hypothesis would still **depend on the chosen alpha (α) level** and the specific hypothesis test being conducted and **this value hasn’t been** provided by the paper.

# E. RESULTS AND CONCLUSIONS.

The paper presents **experimental results comparing the proposed approach** with a baseline using traditional machine learning techniques. While it does not explicitly mention tests for assumptions such as homogeneity of variance, it provides comparison metrics (e.g., precision, recall**, F-measure**) for evaluating the performance of the proposed approach. To assess homogeneity of variance, an F-max test could be conducted on the relevant data points. However, the paper does not provide specific data or results for such a test.

The independent variables include the techniques used for adverse drug reaction (ADR) detection, such as latent semantic analysis (LSA) combined with artificial neural networks (ANNs). The dependent variable is the **F-measure**, which assesses the performance of ADR detection. Given the nature of the data (comparison of performance metrics), appropriate statistical tools for hypothesis testing and comparison, such as t-tests or ANOVA, could have been used.

Also, the paper **includes graph**, which presents a comparison between the baseline and proposed results using a bar chart. This chart **visually illustrates the F-measure comparison**, aiding in understanding the **performance differences between the approaches**. While the paper does not explicitly state hypotheses, it discusses the performance improvement of the proposed approach over the baseline. The results are clearly linked to the objective of demonstrating the effectiveness of LSA with ANN for ADR detection.

The conclusions drawn in the paper appear to be supported by the reported data and analysis. The results consistently show improvement in F-measure with the proposed approach compared to the baseline, indicating the effectiveness of LSA with ANN for ADR detection. The study compared the performance of Latent Semantic Analysis (LSA) combined with Artificial Neural Networks (ANN) against a baseline using traditional machine learning methods for adverse drug reaction (ADR) detection. Results showed that the proposed approach achieved higher **F-measure scores: 85% with TF and ANN,** compared to the baseline **LR score of 82%. LSA with ANN** outperformed other machine learning algorithms due to its ability to correctly identify semantic correspondences. The study concluded that **LSA with ANN improves ADR detection effectiveness**. Future research may explore real-time reviews and apply advanced word embedding techniques with deep learning architectures for further enhancement.