JOURNAL ARTICLE EVALUATION

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Title : Enhanced pedestrian detection using optimized deep convolution neural network for smart building surveillance

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Journal : Springer-Verlag GmbH Germany, part of Springer Nature 2020

Date : 11 May 202

Volume : 1

Pages : 12

A. <u>INTRODUCTION</u>

1. The title of the research article "Enhanced pedestrian detection using optimized deep convolution neural network for smart building surveillance" does provide an indication of the type of study being reported. The title suggests that the study focuses on enhancing pedestrian detection using a specific method, namely an optimized deep convolutional neural network (CNN), for the purpose of smart building surveillance.

   The use of the term "enhanced" implies an improvement or optimization of an existing method, which suggests that the study could involve experimental or comparative research. Furthermore, the mention of "optimized deep convolution neural network" indicates that the study involves the development or modification of a neural network model, which often involves experimental or descriptive research methods to evaluate the effectiveness of the proposed approach.

   Overall, while the title doesn't explicitly specify the exact type of study (descriptive, correlational, or causal-comparative), it does suggest that the study likely involves experimental or comparative research methods aimed at improving pedestrian detection in the context of smart building surveillance.

2. In the title "Enhanced pedestrian detection using optimized deep convolution neural network for smart building surveillance," the independent and dependent variables are not explicitly mentioned. However, we can infer them based on the context of the study:

   Independent Variable:

   The independent variable in this study is likely the deep convolutional neural network (CNN) model, specifically the optimized version proposed by the authors. This neural network architecture serves as the tool or method used to enhance pedestrian detection.

Dependent Variable:

The dependent variable in this study is likely the accuracy or performance of pedestrian detection. The study aims to improve the accuracy of pedestrian detection, which is evaluated based on the performance metrics such as accuracy, precision, recall, or F1 score.

While the title does not directly state the independent and dependent variables, we can deduce them from the focus of the study on enhancing pedestrian detection using an optimized deep convolutional neural network for smart building surveillance.

3. The article provides details about the methodology and experimental study conducted to evaluate the proposed approach for pedestrian detection. Statistical tools or techniques are not explicitly mentioned, but the methodology section describes the experimental setup and evaluation metrics used in the study.

   Specifically, the methodology section discusses the implementation of the proposed optimized VGG-16 (OVGG-16) method for pedestrian detection, along with comparisons with other machine learning (ML) and deep learning (DL) models. The performance evaluation of the proposed model is likely conducted using standard metrics such as accuracy, precision, recall, F1 score, and possibly others.

   While statistical tools like t-tests, ANOVA, or regression analysis are not mentioned explicitly, the evaluation metrics used for comparing different models serve as quantitative measures to assess the performance of the proposed approach statistically. These metrics are commonly employed in machine learning and deep learning research for evaluating classification or detection tasks.

   Thus, the methodology section implicitly indicates the use of statistical tools in the form of performance evaluation metrics for comparing the effectiveness of different pedestrian detection models.

B. <u>ANALYZING THE VARIABLES</u>

In the context of the article, the independent variable is primarily the architecture of the convolutional neural network (CNN) model used for pedestrian detection. Specifically, the study focuses on comparing the performance of different CNN architectures, including the proposed optimized VGG-16 (OVGG-16) model, against other machine learning (ML) and deep learning (DL) models. Therefore, the independent variable is the type of CNN architecture employed for pedestrian detection.

The nature of the measurements associated with the independent variable is categorical and ordinal. The different CNN architectures (e.g., VGG-16, ResNet, AlexNet) represent categories or groups within the independent variable. Additionally, the ordinal aspect comes from the fact that these architectures can be ranked in terms of their depth and complexity.

Regarding whether the measurements are continuous or discrete, it depends on the specific parameters of the CNN architectures being evaluated. While aspects such as the number of layers in the network (depth) could be considered discrete measurements, other architectural parameters such as the size of convolutional filters or the number of neurons in each layer could be continuous. However, the primary focus of comparison in the study seems to be on the categorical differences between the architectures rather than continuous variations within each architecture.

C. <u>HYPOTHESES</u>

1. The article does not explicitly state hypotheses in the traditional sense, such as null and alternative hypotheses, as you might find in a formal scientific hypothesis testing framework. However, the article does present clear objectives and research questions, which serve a similar purpose in guiding the study and evaluating its outcomes.

   The objectives of the study are outlined in the abstract and introduction sections, where the authors describe the aim of enhancing pedestrian detection using an optimized deep convolutional neural network (CNN) for smart building surveillance. Additionally, the introduction section provides context by discussing the challenges of pedestrian detection and the potential of deep learning algorithms to address these challenges.

   Furthermore, the article discusses the methodology employed, including the development of the proposed optimized VGG-16 (OVGG-16) model and the comparison with other machine learning (ML) and deep learning (DL) models. The experimental study is described in detail, with information about the dataset used, the evaluation metrics applied, and the comparison between different models.

   While the article lacks explicit hypotheses, it presents clear research questions and objectives, which guide the study and provide a basis for evaluating the effectiveness of the proposed approach. Therefore, while not formulated as hypotheses in the traditional sense, the objectives and research questions are clear and understandable, serving the purpose of guiding the study and assessing its outcomes.

2. The article does not explicitly state formal hypotheses in the traditional sense, such as null and alternative hypotheses. However, we can infer the implicit hypotheses based on the research objectives and the nature of the study.

   Given the context of the study, we can formulate the following implicit hypotheses:

   I. Null Hypothesis (H0)

   - H0: There is no significant difference in the performance of pedestrian detection among different convolutional neural network (CNN) architectures, including the proposed optimized VGG-16 (OVGG-16) model, other pre-trained CNN architectures, and machine learning models.

   II. Alternative Hypothesis (H1)

   - H1: There is a significant difference in the performance of pedestrian detection among different CNN architectures, and the proposed optimized VGG-16 (OVGG-16) model outperforms other pre-trained CNN architectures and machine learning models.

   These hypotheses can be inferred from the study's objective of evaluating the effectiveness of the proposed optimized CNN model for pedestrian detection compared to other existing models. The null hypothesis assumes no difference in performance, while the alternative hypothesis suggests a difference favoring the proposed optimized CNN model.

   In terms of appropriateness, while the study does not explicitly state formal hypotheses, the implicit hypotheses align with the study's objectives and research questions. The focus of the study is on comparing the performance of different models for pedestrian detection, which fits well with the concept of null and alternative hypotheses testing to assess differences in performance. Therefore, the implicit hypotheses are appropriate for guiding the study and evaluating its outcomes.

3. The article does not explicitly mention a specific alpha risk level (α) for rejecting the null hypothesis. The alpha level represents the significance threshold used in hypothesis testing, indicating the probability of incorrectly rejecting the null hypothesis when it is actually true.

   In cases where the alpha level is not specified, a common default value used in scientific research is $\alpha = 0.05$. This indicates that there is a 5% chance of incorrectly rejecting the null hypothesis when it is true. However, without explicit mention in the article, we cannot definitively state the alpha level chosen by the authors.

   Given the standard practices in scientific research, it is reasonable to assume that the authors might have used the conventional alpha level of 0.05. This level is widely accepted in many fields and provides a balance between sensitivity to detect significant effects and controlling the risk of Type I errors.

   Therefore, while the article does not specify a specific alpha risk level, it is plausible to infer that the authors might have used an alpha level of 0.05 unless stated otherwise.

D. SAMPLE

The article does not provide specific details regarding the sample size (N) or the standard deviation of the data, which are necessary to compute the standard error of the mean. Without this information, it is not possible to determine whether the sample size was large enough or to compute the standard error of the mean.

Regarding the critical region for rejection of the null hypothesis, the article does not specify a significance level (alpha) or provide data for statistical analysis. Typically, the critical region for rejection of the null hypothesis is determined based on the chosen alpha level, which represents the probability threshold for considering a result statistically significant.

If we were to assume a conventional alpha (α) level of 0.05, the critical region for rejection of the null hypothesis would be defined by the corresponding z-score or t-score based on the chosen alpha level and the degrees of freedom (if using a t-distribution). However, without specific data or information provided in the article, it is not possible to determine the critical region for rejection of the null hypothesis.

In summary, without the necessary data or information provided in the article, it is difficult to assess whether the sample size was adequate, compute the standard error of the mean, or determine the critical region for rejection of the null hypothesis. These aspects would require specific numerical values or statistical information that are not provided in the text.

E. RESULTS AND CONCLUSIONS

1. The article does not explicitly mention the use of specific statistical tools or tests, such as testing for homogeneity of variance using an F-max test. However, based on the nature of the study and the variables involved, appropriate statistical tools should have been employed to ensure the validity and reliability of the findings.

   A.
   Testing for homogeneity of variance, also known as homoscedasticity, is essential when conducting analyses such as analysis of variance (ANOVA) or t-tests. It assesses whether the variances of the dependent variables are approximately equal across different groups or conditions. If the assumption of homogeneity of variance is violated, it can affect the accuracy of statistical tests and lead to erroneous conclusions.

   To conduct a test for homogeneity of variance, one common approach is to use Levene's test or Bartlett's test. Levene's test is a widely used method for testing the equality of variances across groups. It involves calculating the absolute deviations of each observation from the group mean and then comparing these deviations across groups using an appropriate statistical test (e.g., F-test).

   Unfortunately, without access to the actual data from the study, I'm unable to perform a Levene's test to assess the homogeneity of variance.

B.
The nature of measurement for both the independent and dependent variables can indeed influence the choice of statistical tools. Depending on whether the variables are categorical or continuous and their level of measurement (nominal, ordinal, interval, or ratio), different statistical analyses may be appropriate.

For example:

- If the independent variable is categorical (e.g., types of CNN architectures) and the dependent variable is continuous (e.g., pedestrian detection accuracy), an analysis of variance (ANOVA) could be suitable to compare means across multiple groups.

- If both the independent and dependent variables are continuous, a correlation analysis (e.g., Pearson correlation coefficient) could be used to assess the relationship between them

- If the dependent variable is categorical (e.g., pedestrian detection success/failure) and the independent variable is continuous, logistic regression could be employed.

In summary, appropriate statistical tools should have been used in the study to address the research questions and analyze the data effectively. This includes testing assumptions such as homogeneity of variance and selecting statistical tests based on the nature and level of measurement of the variables involved.

2. The article does not mention the use of graphic charts to present the results. However, incorporating visual aids such as charts or graphs can often enhance the clarity and interpretability of the findings.

   A.
   If graphic charts were used, their helpfulness in showing the results would depend on factors such as the clarity of the presentation, the appropriateness of the chosen chart type, and whether they effectively communicate key findings to the reader. Graphs that are well-designed and appropriately labeled can provide a clear visual representation of data, making it easier for readers to understand trends, patterns, and relationships.

   B.
   Since the article does not provide specific data for constructing charts, I can't create them directly from reported data. However, if we had access to relevant data from the study, we could consider constructing various types of charts based on the variables and research questions.

   <u>For example:</u>

   - If comparing the pedestrian detection accuracy of different models, a bar graph could be constructed with each bar representing the accuracy percentage for each model.

   - If examining the distribution of pedestrian detection accuracy across the dataset, a histogram could be created to illustrate the frequency of accuracy values within different ranges.

   - If analyzing the relationship between variables (e.g., model accuracy and dataset characteristics), a scatter plot or line graph could be used to visualize the relationship.

   These are just a few examples of the types of charts that could be constructed depending on the specific data and objectives of the study. Visual representations like charts or graphs can be powerful tools for conveying complex information in a clear and accessible manner.

3. There is no direct mention of hypotheses being tested or related results. The comparison primarily focuses on evaluating the performance of different models in pedestrian detection, particularly emphasizing the superiority of the OVGG-16 architecture over VGG-16 and HMPD algorithms.

   However, the absence of explicit hypotheses does not necessarily indicate a flaw in the study. In some cases, particularly in applied research or engineering studies like this one, the focus may be more on the practical outcomes and performance evaluation of different methodologies rather than testing specific hypotheses.

   If hypotheses were indeed proposed but not explicitly stated in the excerpt, it would be important to assess whether the results discussed align with the expectations laid out in those hypotheses. Without the hypotheses explicitly provided, it's challenging to determine whether the investigator relates the results to them.

4. Based on the provided excerpt, the investigator does not seem to over-conclude. Instead, the conclusions drawn appear to be supported by the data presented in the study. The conclusions primarily focus on the performance comparison of different deep learning models for pedestrian detection, particularly highlighting the effectiveness of the proposed OVGG-16 architecture.

   The conclusions are supported by specific performance metrics such as accuracy, precision, recall, and F1 score, which are calculated and compared for OVGG-16, VGG-16, and HMPD algorithms. Additionally, the text provides tables and visualizations to present the performance analysis results, adding credibility to the conclusions drawn.

   Overall, the investigator's conclusions seem to be well-supported by the data and analysis presented in the study.