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# *TRAIN OF TRAINER REAL WORLD MACHINE LEARNING PRACTICE TEACHING WITH K-NEAREST NEIGHBORS (KNN) CLASSIFICATION ALGORITM*

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**Abstrak**

Kegiatan "Train of Trainer" (ToT) yang bertujuan untuk meningkatkan kompetensi teknologi pendidik sekolah menengah atas melalui pengenalan dan penerapan pembelajaran mesin, khususnya berfokus pada algoritma K-Nearest Neighbors (KNN). Program ini disusun menjadi empat tahap utama: Analisis Kebutuhan, Persiapan, Implementasi, dan Evaluasi. Melalui kombinasi sesi teori, pelatihan langsung, dan diskusi, para peserta memperoleh pengetahuan dasar dalam klasifikasi data menggunakan teknik pembelajaran mesin. Hasil evaluasi menunjukkan peningkatan moderat dalam kompetensi peserta, dengan mayoritas menyatakan puas dengan kualitas dan relevansi pelatihan. Namun, beberapa area untuk perbaikan diidentifikasi, termasuk kebutuhan untuk model pelatihan yang lebih bervariasi dan penyajian materi yang lebih jelas. Inisiatif ini menggarisbawahi pentingnya membekali pendidik dengan keterampilan teknologi modern untuk mendorong inovasi dan menjembatani kesenjangan antara praktik pendidikan dan lanskap teknologi yang terus berkembang.

**Kata Kunci:** Train of Trainer, Pembelajaran Mesin, K-Nearest Neighbors, Pelatihan Guru, Klasifikasi Data.

**Abstract**

*The "Train of Trainer" (ToT) activity aims at enhancing the technological competency of high school educators through the introduction and application of machine learning, specifically focusing on the K-Nearest Neighbors (KNN) algorithm. The program was structured into four key stages: Needs Analysis, Preparation, Implementation, and Evaluation. Through a combination of theory sessions, hands-on training, and discussions, the participants gained foundational knowledge in data classification using machine learning techniques. Evaluation results showed a moderate improvement in participants' competency, with the majority expressing satisfaction with the training's quality and relevance. However, some areas for improvement were identified, including a need for more varied training models and clearer material presentation. This initiative underscores the importance of equipping educators with modern technological skills to foster innovation and bridge the gap between educational practices and the evolving technological landscape.*

***Keywords*****:** *Train of Trainer, Machine Learning, K-Nearest Neighbors, Teacher Training, Data Classification.*

## INTRODUCTION

Machine learning has experienced unprecedented growth over the past decade, permeating various industries and significantly impacting their operational efficiency. Its application extends beyond automation and prediction tasks, influencing fields such as healthcare, finance, and education. In the realm of education, machine learning offers unparalleled opportunities for enhancing instructional methods and promoting deeper understanding among students. Studies have shown that incorporating machine learning concepts into educational frameworks can lead to more personalized and effective learning experiences (Rashid & Kausik, 2024).

For instance, recent trends indicate a shift towards adaptive learning systems powered by machine learning algorithms. These systems analyze individual student performances and tailor educational content accordingly, thereby moving away from the traditional one-size-fits-all approach. Moreover, initiatives aimed at integrating AI-driven tools into classrooms are gaining traction worldwide. Institutions are recognizing the imperative of equipping educators with modern technological skills to prepare students adequately for future careers demanding proficiency in data science and related disciplines (Permana et al., 2023).

Despite these advances, there remains a notable gap in technological expertise among high school teachers. Specifically, few educators possess sufficient knowledge regarding machine learning principles and their practical applications. This deficiency hampers efforts to integrate cutting-edge technologies seamlessly into teaching practices. Consequently, students often miss out on exposure to contemporary skill sets crucial for navigating today's technologically driven workforce. Furthermore, inadequate preparation limits teachers' ability to foster innovation within their classrooms—a critical aspect considering the rapidly evolving nature of technological landscapes (Urai Salam et al., 2024).

Addressing this gap is paramount because it affects both immediate educational goals and long-term career prospects for students. Without adequate technological competencies among educators, schools struggle to align curriculum standards with industry expectations. This misalignment undermines efforts aimed at developing digitally literate graduates capable of contributing meaningfully in an increasingly automated economy (UNESCO, 2023).

Our Community Engagement Program focuses on addressing this technological divide through a Train-of-Trainers (ToT) workshop specifically designed for high school teachers. The primary objective of our initiative is to equip participating educators with foundational knowledge in machine learning concepts and tools. We aim to empower these trainers so they can effectively integrate AI-driven innovations into their daily teaching routines. By doing so, we envision cascading benefits extending beyond individual participants; trained teachers will disseminate their newfound expertise among colleagues and students alike (Modi, 2021).

Through this workshop, we seek not merely technical competence but also pedagogical acumen required for seamless incorporation of machine learning techniques into mainstream educational

settings. Our goal is multifaceted—to enhance teacher preparedness, promote educational innovation, and ultimately bridge the gap between current pedagogies and emerging technological paradigms.

The significance of our project transcends localized improvements in teaching methodologies; it contributes substantively toward broader educational reforms aligned with global trends in technology-enhanced learning. Policies such as those outlined under India's National Education Policy (NEP) 2020 advocate strongly for digital literacy and computational thinking skills among student (Modi, 2021). Similarly, international bodies emphasize the importance of equipping educators with modern technological competences to ensure sustainable educational futures.

Furthermore, empowering teachers via targeted workshops like ours fosters systemic transformations within educational ecosystems. It promotes active participation from stakeholders at every level—from policymakers crafting supportive regulations to practitioners implementing evidence-backed interventions. Ultimately, our effort aims at creating an ecosystem conducive to continuous improvement where technological advancements serve as catalysts rather than barriers in achieving excellence in education.

## METHOD

The implementation of the ToT (Training of Trainers) program for high school teachers in the introduction and application of machine learning is carried out systematically in four main stages: Needs Analysis, Preparation, Implementation, and Evaluation. A detailed explanation of each stage is provided in Figure 1 below:

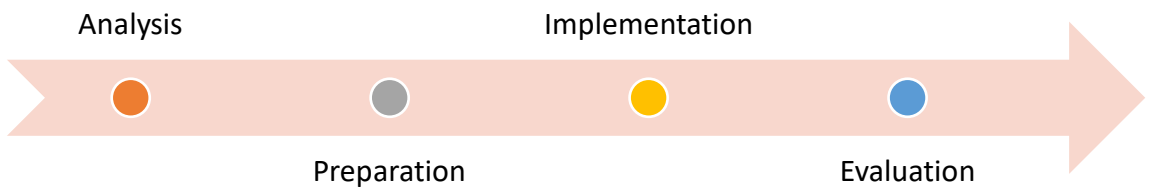


**Figure 1.** Methods used in Train of trainers

A. Analysis

The needs analysis stage aims to identify the training needs of teachers, especially in understanding and mastering the KNN algorithm for data classification. The main activity at this stage is the initial survey, which is conducted through direct discussions with teacher representatives. This survey aims to understand the need for technology-based training that is relevant to the context of learning in schools. The results of this survey serve as a reference for designing training materials and methods.

B. Preparation

In the preparation stage, various technical and non-technical aspects are prepared to support the implementation of the training. Activities carried out include:

- Preparation of Training Modules and Media: Training materials are prepared in the form of modules that cover the theory of the KNN algorithm, implementation using software, and case studies related to education. Supporting media, such as presentation slides and practice files in .ipynb format (Python notebooks), are also prepared.
- Preparation of Facilitators and Facilities: Computer laboratories and other supporting facilities are ensured to be in a ready condition to support the smooth running of the training.
- Preparation of Training Schedule: The training schedule is designed to suit the availability of time for the teachers who will be participants.

C. Implementation

The implementation phase is carried out using the Train of Trainers (ToT) approach, which includes several core activities:

- Theory Session: Participants gain a basic understanding of the concept of classification, an introduction to the KNN algorithm, and its application in various real-world scenarios, especially in the field of education.
- Practical Session (Hands-on Training): Participants are trained to use Google Colab software to perform data analysis, apply the KNN algorithm for classification, and interpret classification results for decision making.
- Discussion and Mentoring: Participants are encouraged to actively discuss, both with facilitators and fellow participants, in order to solve technical problems or deepen their understanding of the concepts taught.

D. Evaluation

The evaluation stage is carried out to measure the success of the training and includes the following steps:

- Pre-Test: Carried out before the training to assess the initial competency of participants.
- Post-Test: Carried out after the training to evaluate the increase in participant competency.
- Satisfaction Questionnaire: Teachers are asked to fill out a questionnaire to provide an assessment of the material, training methods, and facilitators. Measurements are carried out using a Likert scale to obtain quantitative data on the level of participant satisfaction.

## RESULT

The "Train of Trainer" program designed to equip educators with the skills to teach classification using the K-Nearest Neighbors (KNN) algorithm was held on October 8, 2024.

**Figure 2.** Study Session

**Table 1.** Pre-Test and Post-Test Question

| *No* | *Question* |
|---|---|
| 1 | What is the first step in developing a machine learning model? |
| 2 | What is the main purpose of Exploratory Data Analysis (EDA)? |
| 3 | Data pre-processing steps include the following, except: |
| 4 | Data pre-processing steps include the following, except: |
| 5 | Why is the data divided into training and testing sets? |
| 6 | What to consider when choosing a model for a machine learning problem? |
| 7 | During model training, what data is used to improve model performance? |
| 8 | What is the purpose of hyperparameter tuning? |
| 9 | What are the common metrics used to evaluate the performance of a classification model? |
| 10 | When a machine learning model overfits, the model performance will? |

The session commenced with a pre-test for the attending teachers, designed to evaluate their initial competency levels prior to the delivery of materials and practice sessions. This was followed by a post-test conducted after the sessions to gauge how well participants understood and absorbed the training content. Below are the results of the pre-test:

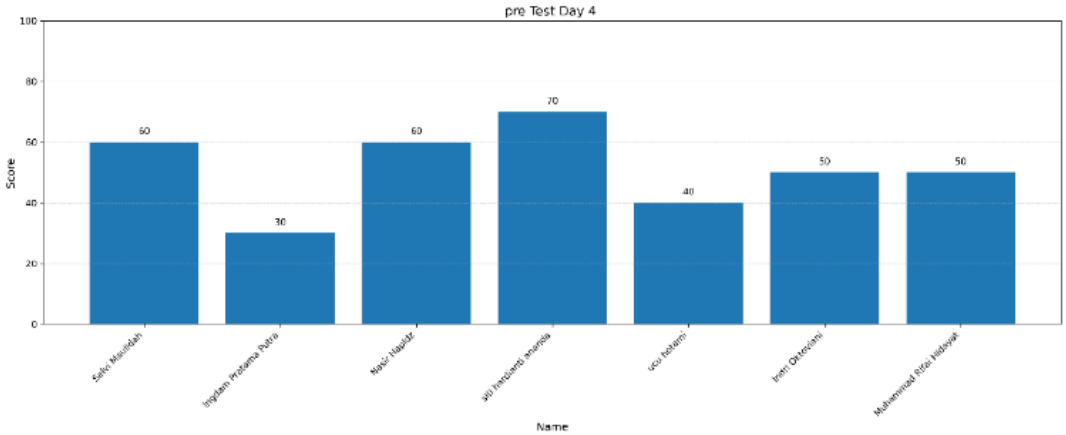


**Figure 3.** Pre-test result

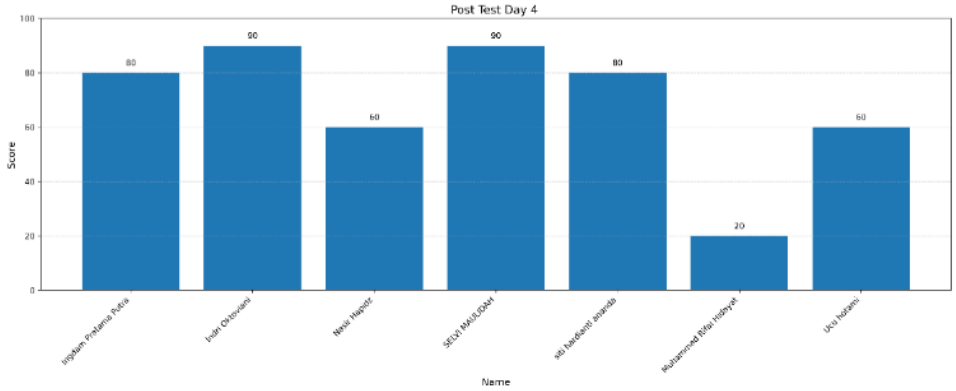


**Figure 4.** Post-test result

The activity commenced with a pre-test designed to assess the initial competencies of participants, particularly the attending teachers, prior to the delivery of instructional materials and practice sessions. Following the completion of these sessions, a post-test was conducted to evaluate the extent to which participants had understood and assimilated the training content.

A moderate improvement in learning outcomes was observed, with four out of seven participants achieving a post-test score of 80 or higher. The class average increased from 51.42 in the pre-test to 68.85 in the post-test. These results indicate that workshop participants acquired new knowledge and insights, although the level of improvement remains categorized as moderate.

The highest score achieved in the pre-test was 70, obtained by one participant, while the lowest score was 30. This distribution provides an overview of the participants' initial knowledge of the reviewed material.

In the post-test, the highest score recorded was 90, achieved by one participant, while the lowest score was 20. These findings suggest an improvement in participants' understanding of the training material, albeit not yet substantial for all participants.

Although the increase in the average post-test score compared to the pre-test score was not significant, the evaluation results demonstrate that a learning process has taken place effectively. This marks a promising starting point for building a deeper and more comprehensive understanding in the future.

Following the presentation on classification using the K-Nearest Neighbors (KNN) algorithm and its practical application, a final evaluation was administered at the conclusion of the session. Participants were instructed to complete this evaluation, with their responses assessed using a Likert scale. The response categories were represented by the following labels: Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A), and Strongly Agree (SA). The Likert-scale questions are detailed in Table 2, while the participants' responses are summarized in Table 3. The resulting table is presented below:

**Table 2.** Evaluation Question

| *No* | *Question* |
|---|---|
| 1 | The training duration was appropriate for the material delivered. |
| 2 | The training I attended was conducted according to the provided schedule. |
| 3 | During the training, the assigned committee members displayed discipline. |
| 4 | During the training, the assigned committee members acted politely and courteously. During the training, the assigned committee members acted politely and courteously. |
| 5 | During the training, the assigned committee members were friendly. |
| 6 | The committee assisted participants in installing the required software effectively. |
| 7 | The committee prepared modules to be used as training guides. |
| 8 | The committee prepared templates to serve as training aids. |
| 9 | The material arrangement was aligned with the training objectives. |
| 10 | The material delivered was consistent with the training objectives. |
| 11 | The material provided met my expectations when I decided to join this training. |
| 12 | The material provided met my needs. |
| 13 | The material provided helped me improve my knowledge of Machine Learning. |
| 14 | The material provided helped me enhance my Machine Learning skills. |
| 15 | The module used as a learning guide was clearly structured. |
| 16 | The module layout for participant learning guidance was well-organized. |
| 17 | The module layout was visually appealing. |
| 18 | The module provided as a learning guide facilitated my learning process. |
| 19 | The learning media used was appropriate for the material delivered. |
| 20 | The training model used was engaging. |
| 21 | The training model used was varied. |
| 22 | The training method employed was highly engaging. |
| 23 | The instructor was able to answer participants' questions effectively and clearly. |
| 24 | The instructor used language that was easy to understand when explaining or answering participants' questions. |
| 25 | During the training, the instructor displayed discipline. |
| 26 | During the training, the instructor acted politely and courteously. |
| 27 | During the training, the instructor was friendly. |
| 28 | Overall, the training program I attended met my expectations. |
| 29 | Overall, the training program I attended was relevant to my needs. |
| 30 | Overall, the training program I attended successfully developed my potential. |

**Table 3.** Evaluation Answer

| *No* | *SD* | *D* | *N* | *A* | *SA* |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 3 | 4 |
| 2 | 0 | 0 | 0 | 1 | 6 |
| 3 | 0 | 0 | 0 | 0 | 7 |
| 4 | 0 | 0 | 0 | 0 | 7 |
| 5 | 0 | 0 | 0 | 1 | 6 |
| 6 | 0 | 0 | 0 | 2 | 5 |
| 7 | 0 | 0 | 0 | 2 | 5 |
| 8 | 0 | 0 | 0 | 0 | 7 |
| 9 | 0 | 0 | 0 | 0 | 7 |
| 10 | 0 | 0 | 0 | 0 | 7 |

| | | | | | |
|---|---|---|---|---|---|
| 11 | 0 | 0 | 0 | 2 | 4 |
| 12 | 0 | 0 | 0 | 2 | 4 |
| 13 | 0 | 0 | 0 | 1 | 6 |
| 14 | 0 | 0 | 0 | 2 | 5 |
| 15 | 0 | 0 | 0 | 3 | 4 |
| 16 | 0 | 0 | 0 | 4 | 3 |
| 17 | 0 | 0 | 0 | 1 | 6 |
| 18 | 0 | 0 | 0 | 2 | 5 |
| 19 | 0 | 0 | 0 | 1 | 6 |
| 20 | 0 | 0 | 0 | 3 | 4 |
| 21 | 0 | 0 | 1 | 3 | 3 |
| 22 | 0 | 0 | 0 | 2 | 5 |
| 23 | 0 | 0 | 0 | 2 | 5 |
| 24 | 0 | 0 | 0 | 4 | 3 |
| 25 | 0 | 0 | 0 | 1 | 6 |
| 26 | 0 | 0 | 0 | 1 | 6 |
| 27 | 0 | 0 | 0 | 1 | 6 |
| 28 | 0 | 0 | 1 | 1 | 5 |
| 29 | 1 | 0 | 1 | 2 | 3 |
| 30 | 0 | 0 | 0 | 3 | 4 |

Based on the results of the training evaluation, the majority of participants gave highly positive ratings across various aspects of the training, ranging from its implementation to the quality of the materials presented. Overall, the training duration, adherence to schedule, and the discipline and friendliness of the organizing committee and instructors received high scores. This indicates that the training program was well-managed, creating a professional environment that supported the learning process.

However, there are several areas that could still be improved, such as increasing the variety of training models and enhancing the modules and presentation of materials. Some participants also provided slightly lower ratings regarding the relevance of the training to their needs and the program's ability to fully develop their potential. While the majority of participants felt that the materials were very helpful in enhancing their skills and knowledge, there is still room for better alignment with the specific needs of each participant.

Overall, the training was deemed highly beneficial and relevant by the majority of participants, although there is some room for improvement in certain areas. This evaluation provides a positive outlook on the training program while offering insights for further development to achieve greater satisfaction and more optimal results for all participants.

## CONCLUSION

The "Train of Trainer" program, aimed at equipping educators with the skills necessary to teach classification using the K-Nearest Neighbors (KNN) algorithm, successfully enhanced participants' understanding of the subject. The evaluation results demonstrated positive feedback from the majority of participants, particularly in areas such as the training duration, adherence to schedule, and the

professionalism and approachability of both the committee and instructors. These aspects indicate that the program was well-organized, fostering a conducive environment for learning.

Despite these positive outcomes, there are areas that could benefit from further refinement. Participants suggested improvements in the variety of training models, as well as in the clarity and presentation of the learning materials. Additionally, while most participants felt the content was valuable in advancing their Machine Learning knowledge and skills, some indicated that the training could have been more aligned with their specific needs and expectations.

In conclusion, while the training program was generally effective and met the expectations of most participants, the results also highlight opportunities for further development. Enhancing certain elements, such as the diversity of training methods and the tailoring of content to better address individual needs, could improve future iterations of the program. These insights will be essential for refining the training approach and achieving even greater success in future sessions.

## ACKNOWLEDGMENTS

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