**ASSIGNMENT 3**

**TVC and Literature Review**

**(Due Sunday, November 17, 2024)**

The third step of the project proposal document will be to write the literature review. This step requires several sub-steps. Follow the steps below and finally complete your literature review.

In this assignment, you can use your mind-map. As you remember, your mind-map should represent the main technological domain and sub-domains of your project. If you prepared your mind-map like this, you may use it to find the technological domains of your project. Otherwise, try to find which technological domains your project includes. Then go ahead.

**Hype Cycle Analysis:** Open the “Gartner Hype Cycles.docx” document. In this document, you are going to find the latest hype cycles presented by Gartner. You can also search for the older hype cycles on the internet. Try to find your technological domain in the hype cycles. If you find it, then put that hype cycle in the box and explain the location of this domain on the hype cycle curve.

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| **This project based on relevant technological domains, such as AI-based image recognition and generative AI. Highlighted as a key theme in the 2024 Hype Cycle, it aligns with my project as AI models like Convolutional Neural Networks (CNNs) are important in identifying mushrooms by analyzing visual features such as color and shape. The application includes autonomous AI features, such as decision-making based on user inputs (smell, color changes). This places it close to the "Innovation Trigger" phase from previous Hype cycles.** |

**Development Plan and Priority Areas Research:** In this step, you will examine the 12th Development Plan (2024-2028) prepared by the Strategy and Budget Presidency of the Republic of Turkey and the Priority R&D and Innovation Topics prepared by TUBITAK. Use the documents listed below:

* Development Plan in Turkish 🡪 “Türkiye Cumhuriyeti 12. Kalkınma Planı.pdf”
* Development Plan in English 🡪 “Twelfth-Development-Plan\_2024-2028.pdf”
* Priority R&D Topics 🡪 “Tübitak Öncelikli Ar-Ge ve Yenilik Konuları.pdf” (Note: There is no English version for this document. International students, please translate your technological domains to Turkish, and search them in the document.)

The document taken as a basis is the development plan, therefore some topics in TUBITAK's document will match the topics in the development plan. The topics mentioned in these documents are the topics that our country will focus on in the coming years. The fact that R&D projects are within the framework of these topics allows TUBITAK to give additional points to your projects. Analyze both documents separately to see if your project's main technological domain is included in these documents and write your findings in the box below. Directly state which topic in which document your project's main technological domain matches. *Example: my tech domain matches "401.4. The fight against informality will be carried out with risk analysis activities supported by technological opportunities such as artificial intelligence and big data, and with the active participation of all parties." in the development plan and “Smart and Artificial Intelligence-Based Technological Solutions within the One Health Framework” under the main title of “R&D and Innovation Issues for the European Green Deal and Adaptation to Climate Change” in the priority areas document.*

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| **On twelfth development plan the projects matches with 489. Smart agricultural practices will be ex panded through digitalization, artificial inteligence and data-based business models, 498. Efficiency will be increased in agricultu ral research, training and extension activities by ensuring coordination among institutions, and the link between agricultural R&D and extension will be strengthened. For TÜBİTAK Priority R&D and Innovation Areas document the project matches with "Innovative IT Applications for Environmental Monitoring".** |

**Technology Value Chain:** Design the technology value chain graph for your project. This graph should include all related technologies in your project. Remember the examples that we discussed in the classroom. Then watch the movie about preparation of the TVC graph. You will find it on the Blackboard. Draw your TVC using MS Visio, Power Point, etc. Put the image of it to the box below:

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**Literature Review:** Finally, write the literature review. You can search the related papers using Google Scholar. You may also use Google itself. Do not use blog pages, newspapers, individual web sites in your literature review. The literature review should represent what has been done so far about your topic. Use APA style for your references. (Search “APA” referencing on the Google.) You can add sub-titles in the literature review. You can look at the examples in the “Literature Review - Examples.rar” file.

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| **Literature Review**  **Several studies focus on leveraging machine learning and image processing techniques to identify edible and poisonous mushrooms. For instance, a study conducted in Sri Lanka utilized Convolutional Neural Networks (CNNs) to classify mushrooms based on physical attributes like shape, size, and color. They achieved a 90% accuracy rate for edible mushroom identification and noted the potential for further improvement through feature optimization and user feedback integration. Studies emphasize the importance of a robust and diverse dataset. High-resolution images captured under consistent lighting conditions significantly improved model accuracy. Preprocessing methods, such as resizing, normalization, and data augmentation (e.g., flipping and rotating images), helped models generalize better to unseen data. [7]**  **The cultivation of edible mushrooms is a trend in the Sri Lankan market. Unfortunately, certain types of mushrooms are deadly and contain toxins that can make people sick or even lead to death. Around 70% of all-natural poisoning is caused by mushrooms, and it frequently results in death. But nonetheless, out of the hundreds of species found on Earth, only 30 to 50 are toxic.[1]**  **The approach will use advanced image processing techniques, such as feature extraction, segmentation, and classification, to analyze images of mushrooms and distinguish between edible and non-edible mushrooms and edible mushroom species. This method has the potential to provide a more accurate and efficient way of identifying mushrooms, which will improve the safety and accessibility of wild mushroom harvesting, promote the consumption of nutritious edible mushrooms, and prevent accidental ingestion of poisonous mushrooms [2] .**  **The one of the algorithms for classification in this study are logistic regression, k-nearest neighbor (KNN), and XGBoost. Three methods were chosen to obtain a multiple comparison. Starting with logistic regression, an uncomplicated regression analysis that provides the probability of an event occurring, ideal for outputting a binary target variable. KNN is a “lazy learning” classification model that uses proximity to make classifications or predictions about the clustering of an individual data point. XGBoost as an already optimized method for classification and regression, ideal for large data sets or data sets that present a mixture of categorical and numerical varieties and simple to use [4]. KNN could be useful for classification projects because it’s easy to implement and there are no model training required because it uses training data directly. The cons of this method could be being slow on prediction time since it computes distances to all points in the dataset. Therefore, there might be performance drop with large datasets.**  **Artificial neural networks (ANN) are parallel computational models with highly linked adaptive processing units that can learn from experience as well as acquire new information. One use of ANN is the classification of mushrooms as either edible or poisonous. [3]**  **Various classification algorithms, including K-Nearest Neighbors (KNN), Naive Bayes, and Decision Trees, have been explored:**  **KNN demonstrated high performance in classifying mushroom datasets with minimal preprocessing but required significant computational resources for large datasets​**  **Random Forests and Decision Trees excelled in accurately distinguishing edible and poisonous species using hierarchical decision structures. The C4.5 algorithm, a variant of Decision Trees, was noted for its efficiency in reducing classification errors. [4,5]**  **The primary challenges include limited dataset and complex classification requirements such as color, shape or even habitat. (Bandara et al. 2023)**  **In their investigation, Nusrat, Zahid, and the other researchers concentrated on identifying different species of mushrooms. They used deep learning methods such as InceptionV3, VGG16, and Resnet50 to classify 8190 images of mushrooms (Zahan et al., 2021). They decided to divide the training and test data by 8:2. To obtain the highest test accuracy, they used InceptionV3 and the Contrast Limited Adaptive Histogram Equalization (CLAHE) method to compare contrast-enhanced and non-contrast-enhanced approaches. With an accuracy of 88.40%, InceptionV3 has the highest success rate when compared to other algorithms. In their study, Wacharaphol et al. tackled the problem of distinguishing between harmful and edible mushrooms because of their similar appearances [9]. Using convolutional neural networks (CNN) and region convolutional neural networks (R-CNN), they categorized the edible and toxic forms of five mushroom species that are frequently found in Thailand: Inocybe rimosa, Amanita phalloides, Amanita citrina, Russula delica, and Phaeogyroporus portentosus. The goal of the study was to reduce the number of deaths caused by toxic mushroom consumption. The study compared the accuracy and test time of three models. Their proposed model had accuracy scores of 95.50% and required less time for training and testing than other CNN studies for mushroom classification.**  **A study was conducted to evaluate the accuracy of three different pre-trained Convolutional Neural Network (CNN) models for image classification. The objective was to determine which model offered the highest recognition accuracy. The dataset used for this research was sourced from ImageNet, with a focus on image recognition, dataset size, classification techniques, and recognition accuracy.**  **The three implemented machine learning models in this study were VGG-16, InceptionV3, and EfficientNetB7. The models achieved the following accuracies:**   * **VGG-16: 97.67%** * **InceptionV3: 97.2%** * **EfficientNetB7: 99%**   **Based on the results, EfficientNetB7 outperformed the other two models, demonstrating the highest accuracy at 99%. This indicates that EfficientNetB7 is the most effective model among the three for image classification tasks in this study [10].**  **Future research recommends incorporating multi-modal inputs, such as combining image-based classification with textual or sensory data (e.g., user-reported smell or texture). This hybrid approach could significantly enhance classification accuracy and usability**  **References**  **[1] Preechasuk, J., Chaowalit, O., Pensiri, F. &**  **Visutsak, P. (2019). Image analysis of**  **mushroom types classification by convolution**  **neural networks. Proceedings of the 2019 2nd**  **Artificial Intelligence and Cloud Computing**  **Conference**  **[2] Kousalya, K., Krishnakumar, B., Boomika, S.,**  **Dharati, N. & Hemavathy, N. (2022). Edible**  **mushroom identification using machine**  **learning. International Conference on Computer**  **Communication and Informatics (ICCCI).**  **[3] Aleksandrova, Y. (2019). Predicting students**  **performance in moodle platforms using machine**  **learning algorithms. Available at: www.semanticscholar.org.**  **Available at:**  **https://www.semanticscholar.org/paper/Predictin**  **g-Students-Performance-in-Moodle-**  **PlatformsAleksandrova/59cdc6a7dc5ab04c258**  **2c4e42bdf9eed1ab010cc [Accessed 19 Mar.**  **2023].**  **[4] Classification and selection of the main features for the identification of toxicity in *Agaricus* and *Lepiota* with machine learning algorithms[2024 january]**  **[5]Developing an Identification System for Different Types of Edible Mushrooms in Sri Lanka using Machine Learning and Image Processing[2023 october]**  **[6]Development of the Edible and Poisonous Mushrooms Classification Model by using the Feature Selection and the Decision Tree Techniques, IJEAT​[2019 december]**  **[7] Developing an Identification System for Different Types of Edible**  **Mushrooms in Sri Lanka using Machine Learning and Image**  **Processing**  **International Journal of Engineering and Management Research**  **[8] Zahan, N., Hasan, M. Z., Malek, M. A., & Reya, S. S. (2021, February 27-28). A Deep Learning-Based Approach for Edible, Inedible and Poisonous Mushroom Classification. In: Proceedings of the International Conference on Information and Communication Technology for Sustainable Development (ICICT4SD), (pp. 440-444).** [**https://www.doi.org/10.1109/ICICT4SD50815.2021.9396845**](https://www.doi.org/10.1109/ICICT4SD50815.2021.9396845)  **[9] Ketwongsa, W., Boonlue, S., & Kokaew, U. (2022). A New Deep Learning Model for the Classification of Poisonous and Edible Mushrooms Based on Improved AlexNet Convolutional Neural Network. Applied Sciences, 12(7), 3409.** [**https://www.doi.org/10.3390/app12073409**](https://www.doi.org/10.3390/app12073409)  **[10] Image Classification using Deep Learning: A Comparative Study of VGG-16, InceptionV3 and EfficientNet B7 Models**  **Published in:** [**2023 3rd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)**](https://ieeexplore.ieee.org/xpl/conhome/10182388/proceeding) |

**Late work will not be accepted. (If you upload your response before the deadline, I can review it and give you feedback, so you will have time to improve your answer.)**