CovidVision: Advanced COVID-19 Detection From Lung X-Rays with Deep Learning

Milestone 1: Project Initialization and Planning Phase

The "Project Initialization and Planning Phase" of the COVIDVISION project marks the outset of developing a deep learning model to detect COVID-19 from lung X-ray images. This phase involves defining the project's goals, scope, and stakeholders, establishing project parameters, identifying key team members, allocating resources, and outlining a realistic timeline. It also includes risk assessment and mitigation planning. Successful initiation sets the foundation for a well-organized and efficiently executed project, ensuring clarity, alignment, and proactive measures for potential challenges in early and accurate COVID-19 detection.

Activity 1: Define ProblemStatement

Problem Statement: The COVID-19 pandemic has strained healthcare systems globally, creating major challenges in diagnosing and managing the surge of cases. Timely and precise diagnosis of COVID-19, especially in areas lacking expert radiologists, is essential for effective treatment and virus containment. Traditional diagnostic methods like RT-PCR tests can be slow and may not be accessible in all regions, worsening the spread of the virus. Therefore, there is an urgent demand for a scalable, efficient, and dependable diagnostic tool to aid healthcare professionals in the early detection and management of COVID-19 cases.

CovidVision Problem Statement Report:Click Here

Activity 2: ProjectProposal (Proposed Solution)

The COVIDVISION project aims to develop a robust machine learning model to detect COVID-19 from lung X-ray images using advanced deep learning and transfer learning techniques. The model will classify lung conditions into four categories: normal, lung opacity, COVID-19, and viral pneumonia. The project involves collecting diverse lung X-ray images, enhancing them through data augmentation, and optimizing a neural network for accuracy and efficiency. The goal is to create a reliable tool for early COVID-19 detection, easily integrated into clinical settings with a user-friendly interface or API for widespread use.

CovidVision Project ProposalReport:Click Here

Activity 3: InitialProject Planning

The initial project planning for COVIDVISION involves setting objectives to develop a deep learning model for detecting COVID-19 from lung X-ray images and classifying lung conditions into four categories. The project scope includes data collection, preprocessing,

augmentation, model development, and interface/API creation for clinical integration. Key stakeholders include data scientists, machine learning engineers, radiologists, software developers, and healthcare professionals. With phases for data collection, model development, validation, and deployment, the strategy focuses on optimizing neural network architecture and creating a user-friendly diagnostic tool to ensure early and accurate COVID-19 detection, supporting healthcare professionals in decision-making.

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Milestone 2: Data Collection and Preprocessing Phase

The Data Collection and Preprocessing Phase involves executing a plan to gather relevant lung X-ray images and their masks from the "Covid-19 Radiography Database" on Kaggle, ensuring data quality through verification and addressing any inconsistencies. Preprocessing tasks include resizing images to 224x224 pixels, normalizing to a 0-1 range, and applying data augmentation techniques such as shearing, rescaling, zooming, and horizontal flipping. Additionally, image cropping to 224x224 pixels and batch normalization with a batch size of 32 are performed to standardize inputs for subsequent exploratory analysis and machine learning model development.

Activity 1: Data Collection Plan,Raw Data SourcesIdentified, Data Quality Report

The dataset for "CovidVision: Advanced COVID19-Detection From Lung X-Rays with Deep Learning" is sourced from Kaggle. It consists of Lung x-ray images of Normal, Lung opacity, Viral pneumonia and Covid. Data quality is ensured in the "Covid-19 Radiography Database" from Kaggle, naming inconsistencies and integration issues with X-ray images and masks are corrected using Python scripts.

CovidVision Data Collection Report:Click Here

Activity 2: Data Quality Report

The dataset for "CovidVision: Advanced COVID19-Detection From Lung X-Rays with Deep Learning" is sourced from Kaggle. To ensure data quality in the "Covid-19 Radiography Database" from Kaggle, naming inconsistencies and integration issues with X-ray images and masks are corrected using Python scripts. Efficient data processing techniques address the challenge of large dataset loading times. GPU limitations on platforms like Google Colab are managed by using alternative accounts for continuous processing.

CovidVision Data QualityReport:Click Here

Activity 3: Data Exploration and Preprocessing

The "Covid-19 Radiography Database" contains 40,000 lung X-ray images and their masks. Preprocessing includes resizing images to 224x224 pixels, normalizing them to a 0-1 range, and applying data augmentation techniques such as shearing, rescaling, zooming, and horizontal flipping. Image cropping is performed at 224x224 pixels, and batch normalization with a batch size of 32 ensures standardized inputs for neural network training. These steps enhance data quality, promote model generalization, and improve convergence.

CovidVision Data Exploration and Preprocessing Report:Click Here

Milestone 3: Model Development Phase

The Model Development Phase for future deep learning and computer vision projects, various architectures, such as CNNs or RNNs, will be evaluated. Factors such as performance, complexity, and computational requirements will be considered to determine the most suitable model for the task at hand.

Activity 1: Model Selection Report

The ModelSelection Report evaluates four neural network architectures for their suitability in detecting COVID-19 from lung X-ray images. EfficientNetB0, with its compound scaling method, offers high accuracy with fewer parameters. Xception, utilizing depthwise separable convolutions, ensures high performance and efficient computational resource usage. VGG16, known for its simplicity and depth, provides effective image classification capabilities. Lastly, Inception's multi-scale feature capture through various convolution filters ensures efficiency and high accuracy. Each model's unique strengths and applications will be considered to determine the best fit for the task.

CovidVision Model Selection Report:Click Here

Activity 2: InitialModel Training Code, Model Validation and Evaluation Report

The Initial Model Training Code will be presented through a screenshot, showcasing the implementation. The model validation and evaluation report will summarize the training and validation performance metrics for multiple models, including screenshots of the neural network summaries for EfficientNetB0 and Xception. Additional models will be evaluated and included in the report as well.

CovidVision Model Development PhaseTemplate:Click Here

Milestone 4: Model Optimization and Tuning Phase

The Model Optimization and Tuning Phase involves refining neural network models to achieve peak performance. This includes optimizing model code, fine-tuning hyperparameters, comparing performance metrics, and justifying the final model selection to enhance predictive accuracy and efficiency.

Activity 1: Hyperparameter Tuning Documentation

Hyperparameters were tuned for the following models:

EfficientNetB0: Epochs, rescaling (0-1), zoom, shear, and batch size were optimized to improve robustness and accuracy.
Xception: Similar hyperparameters were adjusted as above for consistency in performance enhancement.
Inception: Epochs, rescaling, zoom, shear, and batch size were fine-tuned to balance model efficiency.
VGG16: Hyperparameters including epochs, rescaling, zoom, shear, and batch size were optimized for improved results.

Activity 2: Performance Metrics Comparison Report

This report contrasts baseline and optimized metrics for various models, showcasing the enhanced performance achieved through hyperparameter tuning. Performance metrics for EfficientNetB0, Xception, Inception, and VGG16 are compared to highlight improvements.

Activity 3: Final Model SelectionJustification

EfficientNetB0 was selected as the final model due to its superior performance, achieving an accuracy of 87.5%. Its efficient balance between model accuracy and computational cost aligns with project goals, making it the optimal choice for detecting COVID-19 from X-ray images.

CovidVision Model Optimization and Tuning Phase Report:Click Here

Milestone 5: ProjectFiles Submission and Documentation

For projectfile submission in Github, Kindly. Click Here

Milestone 6: Project Demonstration

In the upcoming modulecalled Project Demonstration, individuals will be required to record a video by sharing their screens. They will need to explain their project and demonstrate its execution during the presentation.