Tomato Disease Detection System

Project Report

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ABSTRACT

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ACKNOWLEDGEMENT

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0 " **Dr. Shalini Batra** 1 2
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INTRODUCTION

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Develop a Baseline CNN Model

Utilize Transfer Learning

Performance Comparison 2 . (

Practical Implications <

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LITERATURE SURVEY

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! " # $
! " 9 !

2.1 CNNs in Plant Disease Detection

! " # $ / " + /
Ferentinos (2018) -
/ ==> !
- 9

+ **Lakshmanan et al. (2017)** :
-
- ! !

2.2 Transfer Learning for Enhanced Performance

" + ! **Mohanty et al. (2016)**
/ ' 3
!

Dutta et al. (2020) / / : " &' ' () ; 46
! 9 !

He et al. (2019) + &, *
+ &, 9 ! !
" * !

2.3 Comparative Analysis of Transfer Learning Models

Sharma et al. (2021)

&' ' () ; 46 + &, * ; 46

! **Koirala et al. (2020)** ! ;

" /

2.4 Improving Model Robustness with Data Augmentation

- ! - **Giuffrida et al. (2020)**

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2.5 Challenges and Limitations in Existing Studies

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- **Dataset Diversity** * -

?Real-Time Applications . ! ! "

?Computational Requirements 9 ! !

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METHODOLOGY ADOPTED

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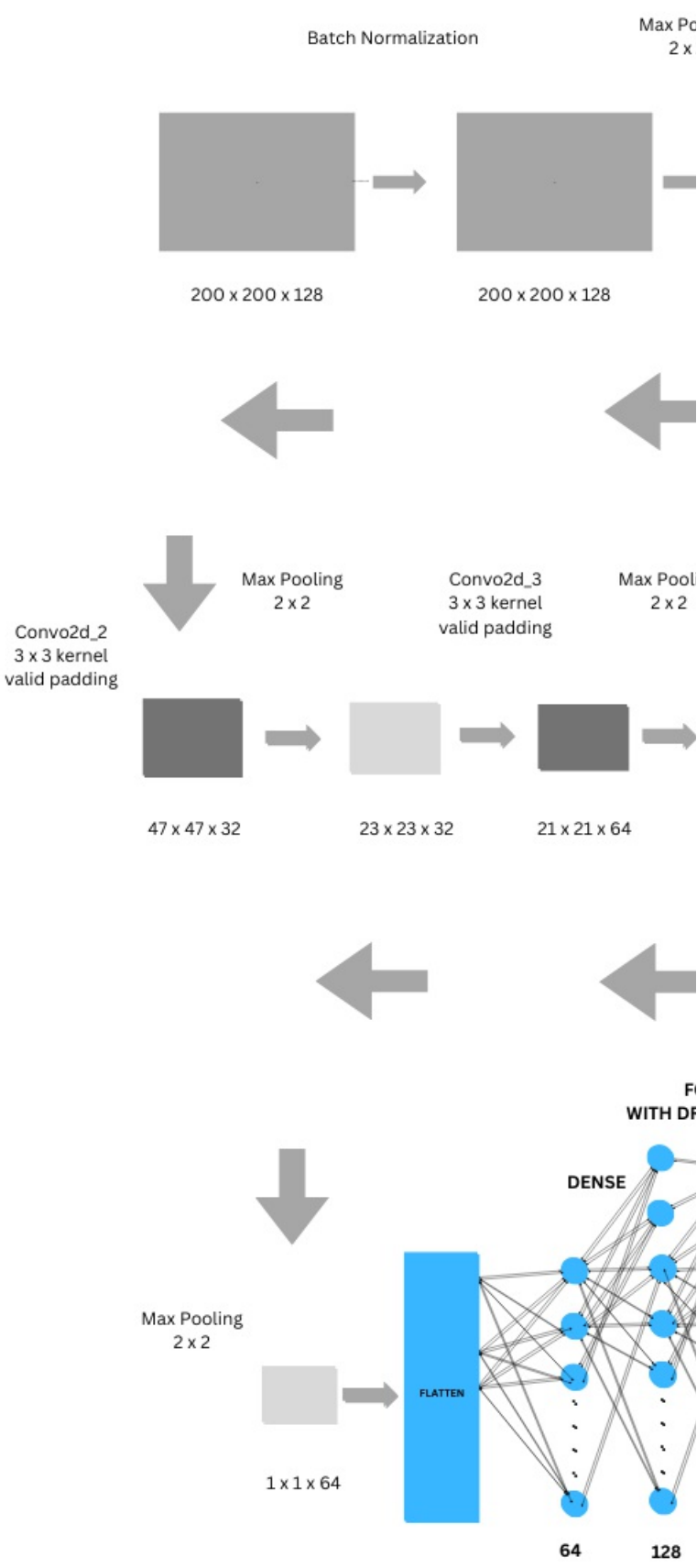
Flow Diagram of System Architecture



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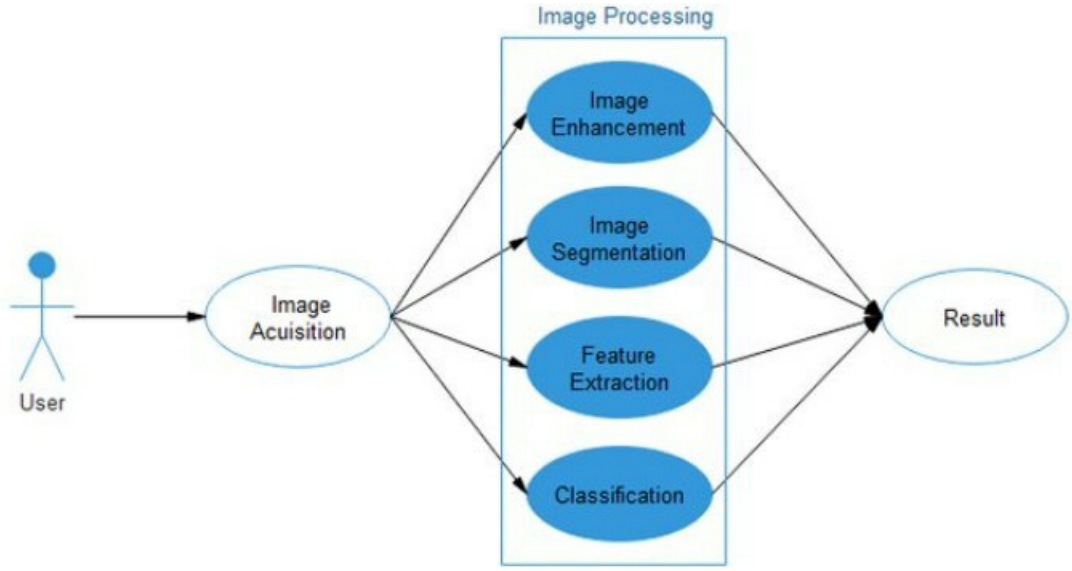
Use Case Diagram of System Architecture



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Data Collection and Preprocessing: +

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Model Selection: :

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Training the Models: #AB CB $

& #AB CB $

Evaluation: * . (

Comparison and Analysis:

Deployment: !

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!

3.1 Data Preprocessing

! !

- **Image Resizing** ! - 557/557 / -

?**Normalization:** </ ! - D6 (E 544

?**Data Augmentation:** 9 - ! -

3.2 Model Development and Training

Baseline CNN

!

- **Architecture**
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- * /
- . ! (5F)7 ! ! /
-

- **Training**
- ! 76 ! - , 5 - 6 66(
- !

Transfer Learning Models

. ! "

- **VGG16**
- ! ! "
- . ! 46 - ! 6 666(
- **DenseNet**
- . ! /
- !
- **MobileNet**
- ! * ! !
- ! - /
- **InceptionV3**
- - /
- !

3.3 Training Setup and Hyperparameters

- **Batch Size:** , 5
- **Epochs** 76 G46
- **Optimizer** -
- **Learning Rate**

3.4 Validation and Performance Evaluation

- **Validation Data:** !
- **Evaluation Metrics:**
- **Accuracy:** H
- **Precision,** ; . (<
- **Loss Curves:** -

3.5 Comparison and Analysis

- ! #&' ' () * + &, $
- * !

3.6 Deployment Considerations

- ! !

! 9

EXPERIMENTS AND RESULTS

4.1 Dataset Details

- **Dataset Composition:**
- -
- + /
- **Data Split:**
- **70%**
- & **15%**
- **15%**

4.2 System Configuration

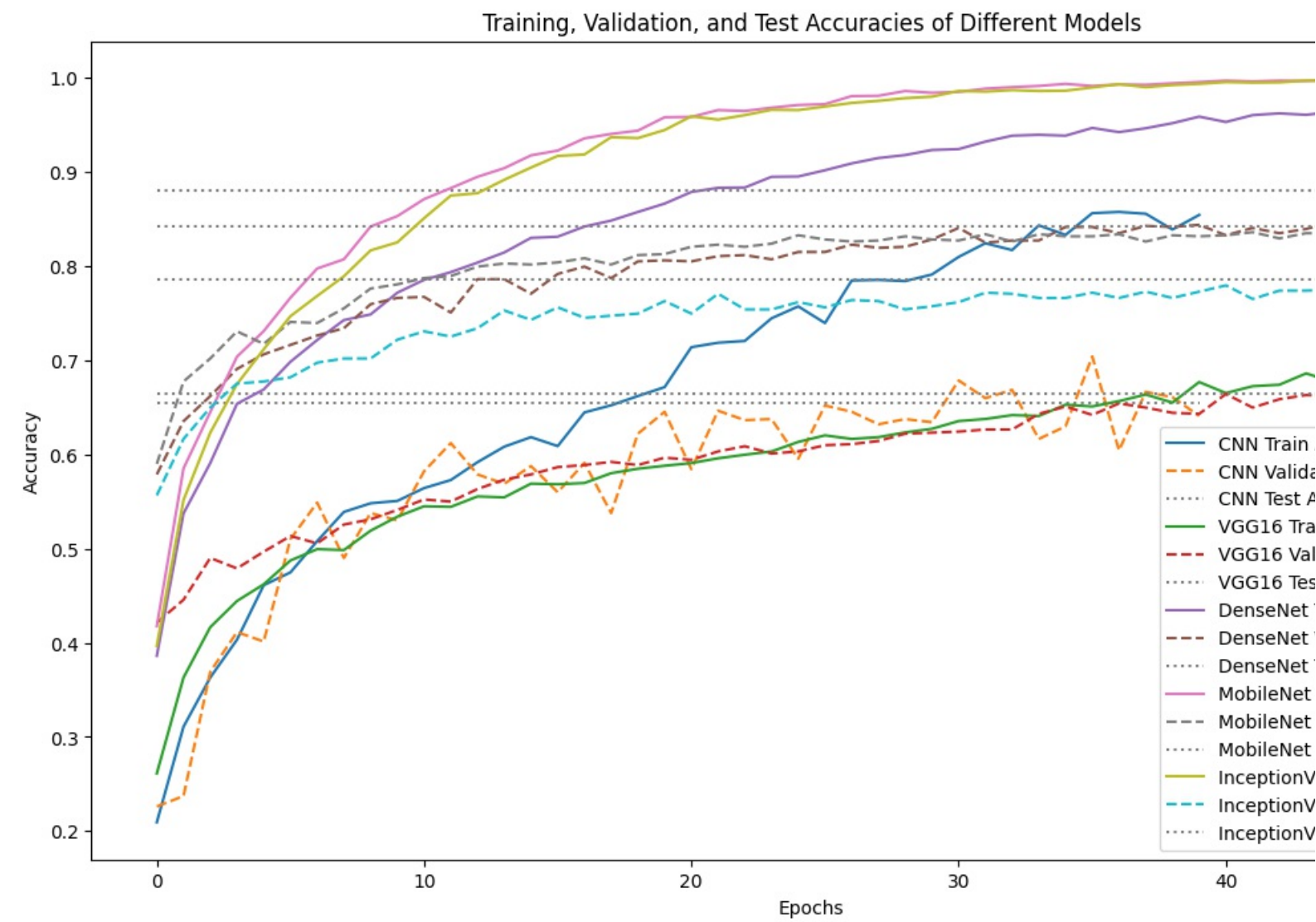
- **Hardware Used:**
- ' <@ &+ + 7 #( ) ' : &; * $
- <@ + A #5 , ' 1 -$
- ; * , 5 ' :
- **Software Environment:**
- . ! " . ! 5 / I <+
- 3 < , F
- H @ 56 67

4.3 Training Details

- **Hyperparameters:**
- 3 ; + **0.001** ! 6 (
- : - **32**
- H - **Adam**
- 0 + - **He Normal**
- **Loss Function:**
- **Categorical Cross-Entropy** ! "
- **Activation Functions:**
- **ReLU**
- **Softmax**
- **Epochs and Iterations:**
- * ! **50 epochs** ! - -
- **Training Timing:**
- /
  - : **3 minutes per epoch**
  - 3 * **DenseNet (6 min), InceptionV3 (5 min), MobileNet (4 min), VGG16 (4.5 min)**
- **Test Timing:**
- 2 "**10-15 seconds**
- **Inference Timing:**
  -
    - : **3 ms**
    - **10 ms**
    - + &, **8 ms**
    - * **5 ms**
    - &' ' () **7 ms**

4.4 Key Observations from Results

- **Training Dynamics:**
- /
- **Validation Results:**
- + &, * ! -
- ! !
- **Test Accuracy:**
- **InceptionV3:** =5 F>
- **MobileNet:** =(7>
- **DenseNet:** =6 8>
- **VGG16:** F8 , >
- **Efficiency Trade-offs:**
- **MobileNet** ! "
- **DenseNet** **InceptionV3**



CONCLUSIONS AND FUTURE SCOPE

5.1 Conclusions

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- **High Classification Accuracy** -
- **Model Efficiency** * ! "
- **Impact of Data Augmentation:** 9
- **Scalability** . ! 9 " "

5.2 Future Scope

- **Real-World Deployment:**
- !
- +
- **Dataset Expansion:**
- 2/ ! J -
- '
- **Model Optimization**
- . - ! " * !
- 2/ 9 - 9 -
- **Integration with IoT and Sensors**
- ! + #+ $
- **Explainable AI**

- / - !
- **Advanced Techniques:**
- +
- 2/
- **Economic Impact Studies:**
- 2

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