



**East West University**

**Department of Computer Science and Engineering**

**Semester: Spring 2024**

## **Assignment Report**

**Course Code:** CSE366

**Course Title:** Artificial intelligence

**Section:** 03

**Assignment No:** 03

**Submitted By,**

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## **Assignment: Computer Vision Assignment**

**Objective:** This assignment is designed to give you practical experience in developing and training deep learning models for computer vision tasks. You have the option to focus on either image classification or object detection, using specific datasets and model architectures.

**Dataset Information:** The dataset contains 1006 leaf images grouped according to their nutritional deficiencies (Boron, Iron, Potassium, Calcium, Magnesium, Manganese, Nitrogen and others). CoLeaf dataset contains images that facilitate training and validation during the utilization of deep learning algorithms for coffee plant leaf nutritional deficiencies recognition and classification.

CoLeaf Dataset	
Class	Frequency
boron-B	101
calcium-Ca	162
iron-Fe	65
magnesium-Mg	79
manganese-Mn	83
nitrogen-N	64
phosphorus-P	246
potassium-K	96
more-deficiencies	104
healthy	6

**Citation:** Tuesta-Monteza, Victor A; Mejia-Cabrera, Heber I.; Arcila-Diaz, Juan (2023), "CoLeaf DATASET", Mendeley Data, V1, doi: 10.17632/brfgw46wzb.1

**Link:** <https://data.mendeley.com/datasets/brfgw46wzb/1>

### **Data Augmentation:**

Augmentation Key factors: rotation\_range=40, width\_shift\_range=0.2, height\_shift\_range=0.2, shear\_range=0.2, zoom\_range=0.2, horizontal\_flip=True, fill\_mode='nearest'.

CoLeaf Augmented Dataset	
Class	Frequency
boron-B	683
calcium-Ca	782
iron-Fe	690
magnesium-Mg	686
manganese-Mn	726
nitrogen-N	686
phosphorus-P	713
potassium-K	747

#### **Data Pre-process:**

Train - 70%

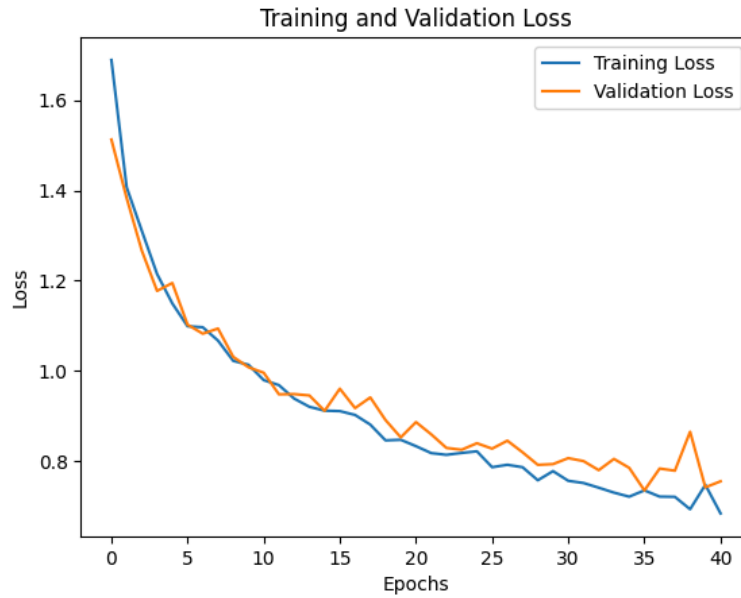
Validation - 20%

Test - 10%

#### **Model Performance:**

##### **Traditional CNN with group normalization:**

Model	Accuracy	Precision	Recall	F1 score
Traditional CNN	71.85%	73.16%	71.89%	71.16%

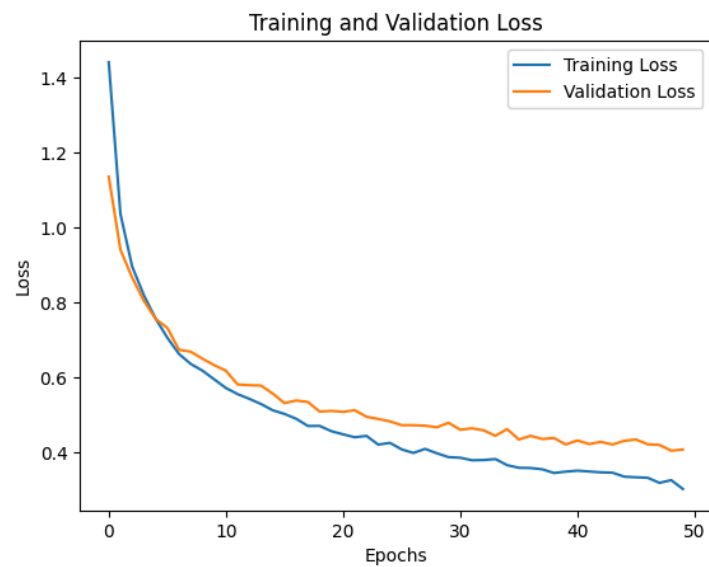


**Confusion Matrix**

True labels	boron-B	47	11	5	1	4	1	0	1
	calcium-Ca	16	42	4	2	6	1	0	0
	iron-Fe	0	2	61	3	2	1	0	0
	magnesium-Mg	1	4	12	38	14	5	2	0
	manganese-Mn	0	3	6	4	51	4	4	0
	nitrogen-N	0	2	0	0	4	64	1	0
	phosphorus-P	0	0	0	0	0	1	72	1
	potassium-K	1	4	0	7	6	1	14	36
		Predicted labels							
		boron-B	calcium-Ca	iron-Fe	magnesium-Mg	manganese-Mn	nitrogen-N	phosphorus-P	potassium-K

## EfficientNet B3:

Model	Accuracy	Precision	Recall	F1 score
EfficientNet B3	86.53%	87.34%	86.77%	86.75%



**Confusion Matrix**

True labels	boron-B	70	2	3	0	0	1	0	1
	calcium-Ca	1	60	2	3	3	0	0	0
	iron-Fe	0	0	64	6	0	1	0	0
	magnesium-Mg	0	0	5	61	4	1	0	0
	manganese-Mn	0	2	6	8	63	2	0	1
	nitrogen-N	0	0	1	1	0	64	0	0
	phosphorus-P	0	0	0	1	1	2	55	5
	potassium-K	1	1	0	6	0	3	3	58
		boron-B	calcium-Ca	iron-Fe	magnesium-Mg	manganese-Mn	nitrogen-N	phosphorus-P	potassium-K
		Predicted labels							

## MobileNet V2:

Model	Accuracy	Precision	Recall	F1 score
MobileNet V2	66.25%	65.41%	64.66%	64.16%



**Confusion Matrix**

True labels	boron-B	63	0	4	1	2	0	0	2
	calcium-Ca	9	49	3	0	7	0	0	1
	iron-Fe	4	2	69	2	1	0	0	0
	magnesium-Mg	3	0	17	24	20	3	0	6
	manganese-Mn	6	3	4	3	36	3	1	3
	nitrogen-N	1	1	1	1	1	63	0	1
	phosphorus-P	1	0	0	5	3	1	60	7
	potassium-K	3	2	0	2	6	3	1	58
		boron-B	calcium-Ca	iron-Fe	magnesium-Mg	manganese-Mn	nitrogen-N	phosphorus-P	potassium-K
		Predicted labels							

## DenseNet 121:

Model	Accuracy	Precision	Recall	F1 score
DenseNet121	73.77%	74.29%	73.42%	72.67%

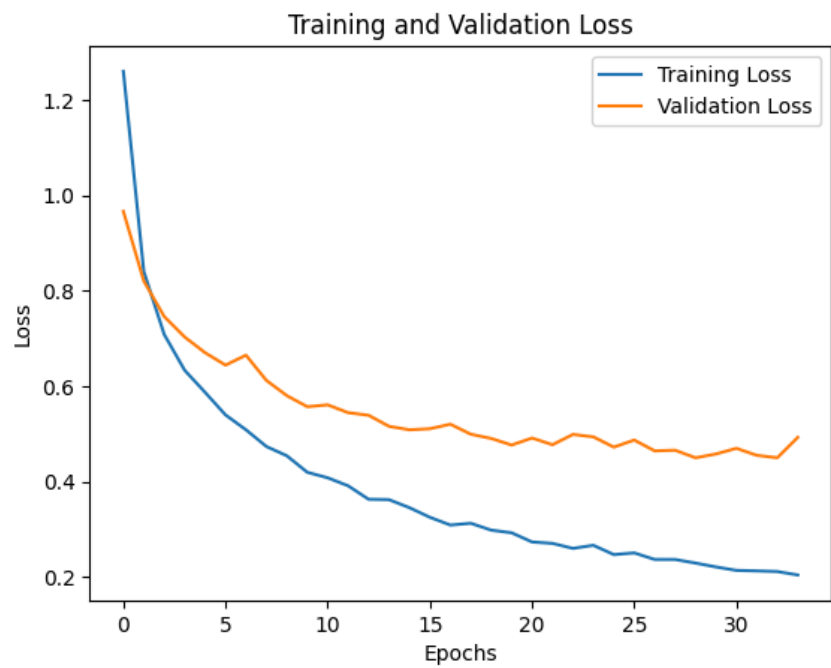


**Confusion Matrix**

True labels	boron-B	63	0	4	1	2	0	0	2
	calcium-Ca	9	49	3	0	7	0	0	1
	iron-Fe	4	2	69	2	1	0	0	0
	magnesium-Mg	3	0	17	24	20	3	0	6
	manganese-Mn	6	3	4	3	36	3	1	3
	nitrogen-N	1	1	1	1	1	63	0	1
	phosphorus-P	1	0	0	5	3	1	60	7
	potassium-K	3	2	0	2	6	3	1	58
		boron-B	calcium-Ca	iron-Fe	magnesium-Mg	manganese-Mn	nitrogen-N	phosphorus-P	potassium-K
		Predicted labels							

**ResNet50:**

Model	Accuracy	Precision	Recall	F1 score
ResNet50	84.79%	85.79%	84.85%	85.02%



		Confusion Matrix							
True labels	boron-B	63	8	0	3	2	0	0	1
	calcium-Ca	2	61	1	0	0	2	0	3
	iron-Fe	0	4	56	6	3	1	0	1
	magnesium-Mg	0	1	3	56	9	2	0	0
	manganese-Mn	1	1	2	5	70	3	0	0
	nitrogen-N	0	0	0	0	4	61	1	0
	phosphorus-P	0	1	0	2	1	4	53	3
	potassium-K	0	0	0	2	3	2	0	65
	Predicted labels	boron-B	calcium-Ca	iron-Fe	magnesium-Mg	manganese-Mn	nitrogen-N	phosphorus-P	potassium-K



**Summary:**

Model	Accuracy	Precision	Recall	F1 score
EfficientNet B3	86.53%	87.34%	86.77%	86.75%
ResNet50	84.79%	85.79%	84.85%	85.02%
DenseNet121	73.77%	74.29%	73.42%	72.67%
Traditional CNN	71.85%	73.16%	71.89%	71.16%
MobileNet V2	66.25%	65.41%	64.66%	64.16%