C:\Users\iitfypvmadmin\PycharmProjects\IIT-MSc-FYP-ML\venv\Scripts\python.exe "C:/Program Files/JetBrains/PyCharm 2023.1/plugins/python/helpers/pydev/pydevconsole.py" --mode=client --host=127.0.0.1 --port=52151

import sys; print('Python %s on %s' % (sys.version, sys.platform))

sys.path.extend(['C:\\Users\\iitfypvmadmin\\PycharmProjects\\IIT-MSc-FYP-ML'])

PyDev console: starting.

Python 3.10.10 (tags/v3.10.10:aad5f6a, Feb 7 2023, 17:20:36) [MSC v.1929 64 bit (AMD64)] on win32

runfile('C:\\Users\\iitfypvmadmin\\PycharmProjects\\IIT-MSc-FYP-ML\\ds\_train\\CNN\_Training.py', wdir='C:\\Users\\iitfypvmadmin\\PycharmProjects\\IIT-MSc-FYP-ML\\ds\_train')

Device - cpu

Full Train Set - 18384

Train Set - 14707

Validation Set - 3677

Test Set - 7982

Available Classes ['අ', 'ආ', 'ඇ', 'ඈ', 'ඉ', 'ඊ', 'උ', 'එ', 'ඒ', 'ඔ', 'ඕ', 'ක', 'කා', 'කැ', 'කෑ', 'කි', 'කී', 'කු', 'කූ', 'ක්', 'ක්\u200dර', 'ක්\u200dරි', 'ක්\u200dරී', 'ග', 'ගා', 'ගැ', 'ගෑ', 'ගි', 'ගී', 'ගු', 'ගූ', 'ா', 'அ', 'ஆ', 'இ', 'ஈ', 'உ', 'ஊ', 'எ', 'ஏ', 'ஐ', 'ஒ', 'ஓ', 'ஔ', 'ஃ', 'க்', 'க', 'கி', 'கீ', 'கு', 'கூ', 'ச்', 'ச', 'சி', 'சீ', 'சு', 'சூ', 'ங்', 'ங', 'ஙி', 'ஙீ', 'ஙு']

Net - Net(

(conv1): Conv2d(1, 16, kernel\_size=(3, 3), stride=(1, 1), padding=(1, 1))

(bn1): BatchNorm2d(16, eps=1e-05, momentum=0.1, affine=True, track\_running\_stats=True)

(conv2): Conv2d(16, 16, kernel\_size=(3, 3), stride=(1, 1), padding=(1, 1))

(bn2): BatchNorm2d(16, eps=1e-05, momentum=0.1, affine=True, track\_running\_stats=True)

(pool1): MaxPool2d(kernel\_size=2, stride=2, padding=0, dilation=1, ceil\_mode=False)

(conv3): Conv2d(16, 32, kernel\_size=(3, 3), stride=(1, 1), padding=(1, 1))

(bn3): BatchNorm2d(32, eps=1e-05, momentum=0.1, affine=True, track\_running\_stats=True)

(conv4): Conv2d(32, 32, kernel\_size=(3, 3), stride=(1, 1), padding=(1, 1))

(bn4): BatchNorm2d(32, eps=1e-05, momentum=0.1, affine=True, track\_running\_stats=True)

(pool2): MaxPool2d(kernel\_size=2, stride=2, padding=0, dilation=1, ceil\_mode=False)

(conv5): Conv2d(32, 64, kernel\_size=(3, 3), stride=(1, 1), padding=(1, 1))

(bn5): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True, track\_running\_stats=True)

(conv6): Conv2d(64, 64, kernel\_size=(3, 3), stride=(1, 1), padding=(1, 1))

(bn6): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True, track\_running\_stats=True)

(pool3): MaxPool2d(kernel\_size=2, stride=2, padding=0, dilation=1, ceil\_mode=False)

(fc1): Linear(in\_features=4096, out\_features=1024, bias=True)

(bn7): BatchNorm1d(1024, eps=1e-05, momentum=0.1, affine=True, track\_running\_stats=True)

(fc2): Linear(in\_features=1024, out\_features=256, bias=True)

(bn8): BatchNorm1d(256, eps=1e-05, momentum=0.1, affine=True, track\_running\_stats=True)

(fc3): Linear(in\_features=256, out\_features=62, bias=True)

)

----------------------------------------------------

[1, 100] loss: 0.004

[1, 200] loss: 0.004

EPOCH : 1

Training loss : 0.6072895861647913

Training accuracy : 84.74875909430884%

Validation loss : 0.2509141638773694

Validation accuracy: 93.69050856676638%

----------------------------------------------------

[2, 100] loss: 0.002

[2, 200] loss: 0.003

EPOCH : 2

Training loss : 0.1866052173908379

Training accuracy : 95.58713537771129%

Validation loss : 0.21311334413388905

Validation accuracy: 94.72395974979602%

----------------------------------------------------

[3, 100] loss: 0.002

[3, 200] loss: 0.001

EPOCH : 3

Training loss : 0.15179915423946702

Training accuracy : 96.7294485619093%

Validation loss : 0.20174819955626097

Validation accuracy: 95.40386184389448%

----------------------------------------------------

[4, 100] loss: 0.001

[4, 200] loss: 0.002

EPOCH : 4

Training loss : 0.14982159758453878

Training accuracy : 96.81104236078058%

Validation loss : 0.18944280835510371

Validation accuracy: 95.78460701658962%

----------------------------------------------------

[5, 100] loss: 0.002

[5, 200] loss: 0.002

EPOCH : 5

Training loss : 0.14695998764284496

Training accuracy : 97.0898211735908%

Validation loss : 0.17113893369893066

Validation accuracy: 96.00217568670112%

----------------------------------------------------

[6, 100] loss: 0.002

[6, 200] loss: 0.002

EPOCH : 6

Training loss : 0.13551712172307157

Training accuracy : 97.38219895287958%

Validation loss : 0.2531927452160024

Validation accuracy: 93.52733206418276%

----------------------------------------------------

[7, 100] loss: 0.002

[7, 200] loss: 0.002

EPOCH : 7

Training loss : 0.13216977405736147

Training accuracy : 97.4297953355545%

Validation loss : 0.1791645148087689

Validation accuracy: 96.43731302692412%

----------------------------------------------------

[8, 100] loss: 0.001

[8, 200] loss: 0.002

EPOCH : 8

Training loss : 0.12287972041020025

Training accuracy : 97.89216019582511%

Validation loss : 0.21546483137116731

Validation accuracy: 94.64237149850422%

----------------------------------------------------

[9, 100] loss: 0.001

[9, 200] loss: 0.001

EPOCH : 9

Training loss : 0.12176379507724551

Training accuracy : 97.89895967906439%

Validation loss : 0.16082389062275082

Validation accuracy: 96.54609736197988%

----------------------------------------------------

[10, 100] loss: 0.001

[10, 200] loss: 0.002

EPOCH : 10

Training loss : 0.12289603612291146

Training accuracy : 97.6881756986469%

Validation loss : 0.14191297503116826

Validation accuracy: 97.19880337231439%

----------------------------------------------------

[11, 100] loss: 0.001

[11, 200] loss: 0.001

EPOCH : 11

Training loss : 0.10859063800449414

Training accuracy : 98.34772557285646%

Validation loss : 0.16003751365717644

Validation accuracy: 96.51890127821594%

----------------------------------------------------

[12, 100] loss: 0.001

[12, 200] loss: 0.001

EPOCH : 12

Training loss : 0.10249395073655752

Training accuracy : 98.35452505609574%

Validation loss : 0.17467470392118759

Validation accuracy: 96.43731302692412%

----------------------------------------------------

[13, 100] loss: 0.001

[13, 200] loss: 0.002

EPOCH : 13

Training loss : 0.09056286318358732

Training accuracy : 98.78289250017%

Validation loss : 0.16237154070501714

Validation accuracy: 96.57329344574381%

----------------------------------------------------

[14, 100] loss: 0.001

[14, 200] loss: 0.002

EPOCH : 14

Training loss : 0.10612952295001038

Training accuracy : 98.33412660637792%

Validation loss : 0.17944993718603497

Validation accuracy: 96.24694044057655%

----------------------------------------------------

[15, 100] loss: 0.001

[15, 200] loss: 0.002

EPOCH : 15

Training loss : 0.09913826802573343

Training accuracy : 98.54491058679541%

Validation loss : 0.15647868381300017

Validation accuracy: 96.81805819961926%

----------------------------------------------------

[16, 100] loss: 0.001

[16, 200] loss: 0.001

EPOCH : 16

Training loss : 0.09022936315517693

Training accuracy : 98.70809818453797%

Validation loss : 0.15577384833573713

Validation accuracy: 97.03562686973076%

----------------------------------------------------

[17, 100] loss: 0.001

[17, 200] loss: 0.001

EPOCH : 17

Training loss : 0.08908118437786937

Training accuracy : 98.75569456721288%

Validation loss : 0.15160120314867043

Validation accuracy: 96.8452542833832%

----------------------------------------------------

[18, 100] loss: 0.001

[18, 200] loss: 0.002

EPOCH : 18

Training loss : 0.08462703789715992

Training accuracy : 98.94608009791256%

Validation loss : 0.15613663608301

Validation accuracy: 96.95403861843894%

----------------------------------------------------

[19, 100] loss: 0.001

[19, 200] loss: 0.001

EPOCH : 19

Training loss : 0.08761450169063274

Training accuracy : 98.78969198340926%

Validation loss : 0.12097671234902721

Validation accuracy: 97.49796029371771%

----------------------------------------------------

[20, 100] loss: 0.001

[20, 200] loss: 0.001

EPOCH : 20

Training loss : 0.07091873887038015

Training accuracy : 99.2452573604406%

Validation loss : 0.1403764385485863

Validation accuracy: 97.66113679630134%

----------------------------------------------------

[21, 100] loss: 0.001

[21, 200] loss: 0.001

EPOCH : 21

Training loss : 0.0904894401824976

Training accuracy : 98.78969198340926%

Validation loss : 0.14673782652864517

Validation accuracy: 97.09001903725863%

----------------------------------------------------

[22, 100] loss: 0.001

[22, 200] loss: 0.002

EPOCH : 22

Training loss : 0.08399281381320571

Training accuracy : 98.92568164819474%

Validation loss : 0.1302669043122085

Validation accuracy: 97.6339407125374%

----------------------------------------------------

[23, 100] loss: 0.001

[23, 200] loss: 0.001

EPOCH : 23

Training loss : 0.07649179564996264

Training accuracy : 99.12286666213367%

Validation loss : 0.14492086330638945

Validation accuracy: 97.55235246124558%

----------------------------------------------------

[24, 100] loss: 0.001

[24, 200] loss: 0.000

EPOCH : 24

Training loss : 0.07756460238226073

Training accuracy : 99.03447338002312%

Validation loss : 0.12387923348815602

Validation accuracy: 97.96029371770464%

----------------------------------------------------

[25, 100] loss: 0.001

[25, 200] loss: 0.001

EPOCH : 25

Training loss : 0.07304306241667893

Training accuracy : 99.25885632691916%

Validation loss : 0.14806449838004943

Validation accuracy: 97.44356812618983%

----------------------------------------------------

[26, 100] loss: 0.000

[26, 200] loss: 0.001

EPOCH : 26

Training loss : 0.08314722758175329

Training accuracy : 99.06167131298021%

Validation loss : 0.1314577249719424

Validation accuracy: 97.44356812618983%

----------------------------------------------------

[27, 100] loss: 0.000

[27, 200] loss: 0.001

EPOCH : 27

Training loss : 0.08152422782897689

Training accuracy : 98.92568164819474%

Validation loss : 0.15061598956212097

Validation accuracy: 97.2803916236062%

----------------------------------------------------

[28, 100] loss: 0.000

[28, 200] loss: 0.001

EPOCH : 28

Training loss : 0.07535492793508768

Training accuracy : 99.09566872917658%

Validation loss : 0.12380616853572378

Validation accuracy: 97.82431329888496%

----------------------------------------------------

[29, 100] loss: 0.001

[29, 200] loss: 0.001

EPOCH : 29

Training loss : 0.07433247923680796

Training accuracy : 99.23165839396206%

Validation loss : 0.1317163744405913

Validation accuracy: 97.6339407125374%

----------------------------------------------------

[30, 100] loss: 0.001

[30, 200] loss: 0.001

EPOCH : 30

Training loss : 0.0722975989059855

Training accuracy : 99.33365064255116%

Validation loss : 0.125176745846053

Validation accuracy: 97.87870546641284%

----------------------------------------------------

[31, 100] loss: 0.001

[31, 200] loss: 0.001

EPOCH : 31

Training loss : 0.06617567961841889

Training accuracy : 99.428843407901%

Validation loss : 0.1370081959906758

Validation accuracy: 97.36197987489801%

----------------------------------------------------

[32, 100] loss: 0.001

[32, 200] loss: 0.001

EPOCH : 32

Training loss : 0.08019930538885078

Training accuracy : 99.19086149452642%

Validation loss : 0.12869811343342707

Validation accuracy: 97.6339407125374%

----------------------------------------------------

[33, 100] loss: 0.001

[33, 200] loss: 0.001

EPOCH : 33

Training loss : 0.06795962293572613

Training accuracy : 99.29965322635479%

Validation loss : 0.14376820920114775

Validation accuracy: 97.22599945607833%

----------------------------------------------------

[34, 100] loss: 0.000

[34, 200] loss: 0.001

EPOCH : 34

Training loss : 0.07722607535638937

Training accuracy : 99.17726252804786%

Validation loss : 0.13686562887767037

Validation accuracy: 97.52515637748164%

----------------------------------------------------

[35, 100] loss: 0.001

[35, 200] loss: 0.001

EPOCH : 35

Training loss : 0.07549397581624022

Training accuracy : 99.1704630448086%

Validation loss : 0.14665292085497672

Validation accuracy: 97.22599945607833%

----------------------------------------------------

[36, 100] loss: 0.001

[36, 200] loss: 0.001

EPOCH : 36

Training loss : 0.0657287595905437

Training accuracy : 99.428843407901%

Validation loss : 0.1432969381474009

Validation accuracy: 97.47076420995377%

----------------------------------------------------

[37, 100] loss: 0.001

[37, 200] loss: 0.000

EPOCH : 37

Training loss : 0.06270938261835793

Training accuracy : 99.54443462296865%

Validation loss : 0.12650959732288053

Validation accuracy: 97.8515093826489%

----------------------------------------------------

[38, 100] loss: 0.001

[38, 200] loss: 0.002

EPOCH : 38

Training loss : 0.06806278471928236

Training accuracy : 99.48323927381519%

Validation loss : 0.14574265447621246

Validation accuracy: 97.57954854500952%

----------------------------------------------------

[39, 100] loss: 0.001

[39, 200] loss: 0.001

EPOCH : 39

Training loss : 0.0854385613649425

Training accuracy : 98.93248113143402%

Validation loss : 0.14694370502423162

Validation accuracy: 96.95403861843894%

----------------------------------------------------

[40, 100] loss: 0.001

[40, 200] loss: 0.001

EPOCH : 40

Training loss : 0.07022145319383781

Training accuracy : 99.23845787720133%

Validation loss : 0.13264155524043503

Validation accuracy: 97.66113679630134%

----------------------------------------------------

[41, 100] loss: 0.001

[41, 200] loss: 0.000

EPOCH : 41

Training loss : 0.06342557822611554

Training accuracy : 99.49003875705446%

Validation loss : 0.10982384057935891

Validation accuracy: 98.47701930921947%

----------------------------------------------------

[42, 100] loss: 0.001

[42, 200] loss: 0.000

EPOCH : 42

Training loss : 0.06396538530239365

Training accuracy : 99.51043720677228%

Validation loss : 0.13836492401508976

Validation accuracy: 97.68833288006527%

----------------------------------------------------

[43, 100] loss: 0.001

[43, 200] loss: 0.001

EPOCH : 43

Training loss : 0.0605373985788277

Training accuracy : 99.5580335894472%

Validation loss : 0.13621725237236615

Validation accuracy: 97.41637204242589%

----------------------------------------------------

[44, 100] loss: 0.001

[44, 200] loss: 0.001

EPOCH : 44

Training loss : 0.07715875426277051

Training accuracy : 99.21805942748351%

Validation loss : 0.15172424457758577

Validation accuracy: 97.30758770737013%

----------------------------------------------------

[45, 100] loss: 0.001

[45, 200] loss: 0.000

EPOCH : 45

Training loss : 0.07220838794071474

Training accuracy : 99.23165839396206%

Validation loss : 0.1155893667774548

Validation accuracy: 98.04188196899646%

----------------------------------------------------

[46, 100] loss: 0.001

[46, 200] loss: 0.001

EPOCH : 46

Training loss : 0.07056136879272834

Training accuracy : 99.25885632691916%

Validation loss : 0.1401312773986974

Validation accuracy: 97.14441120478651%

----------------------------------------------------

[47, 100] loss: 0.000

[47, 200] loss: 0.001

EPOCH : 47

Training loss : 0.06210463936375738

Training accuracy : 99.50363772353302%

Validation loss : 0.12711029335439028

Validation accuracy: 97.8515093826489%

----------------------------------------------------

[48, 100] loss: 0.000

[48, 200] loss: 0.001

EPOCH : 48

Training loss : 0.06383037920543515

Training accuracy : 99.49003875705446%

Validation loss : 0.153279294518955

Validation accuracy: 97.41637204242589%

----------------------------------------------------

[49, 100] loss: 0.001

[49, 200] loss: 0.001

EPOCH : 49

Training loss : 0.07519570712189853

Training accuracy : 99.12966614537295%

Validation loss : 0.14601263443607335

Validation accuracy: 97.38917595866195%

----------------------------------------------------

[50, 100] loss: 0.001

[50, 200] loss: 0.001

EPOCH : 50

Training loss : 0.06372780156928289

Training accuracy : 99.56483307268648%

Validation loss : 0.13119962839837757

Validation accuracy: 97.82431329888496%

----------------------------------------------------

[51, 100] loss: 0.000

[51, 200] loss: 0.001

EPOCH : 51

Training loss : 0.06354362423012888

Training accuracy : 99.47643979057591%

Validation loss : 0.16328187724122023

Validation accuracy: 96.89964645091106%

----------------------------------------------------

[52, 100] loss: 0.001

[52, 200] loss: 0.001

EPOCH : 52

Training loss : 0.07299092601868981

Training accuracy : 99.18406201128714%

Validation loss : 0.13128769848377186

Validation accuracy: 97.90590155017678%

----------------------------------------------------

[53, 100] loss: 0.001

[53, 200] loss: 0.001

EPOCH : 53

Training loss : 0.0632688007940286

Training accuracy : 99.51043720677228%

Validation loss : 0.13189064616705692

Validation accuracy: 97.52515637748164%

----------------------------------------------------

[54, 100] loss: 0.001

[54, 200] loss: 0.001

EPOCH : 54

Training loss : 0.06318633093697425

Training accuracy : 99.53763513972937%

Validation loss : 0.12604939610146945

Validation accuracy: 97.71552896382921%

----------------------------------------------------

[55, 100] loss: 0.001

[55, 200] loss: 0.001

EPOCH : 55

Training loss : 0.06929698233261726

Training accuracy : 99.36084857550826%

Validation loss : 0.13976022332849988

Validation accuracy: 97.36197987489801%

----------------------------------------------------

[56, 100] loss: 0.001

[56, 200] loss: 0.000

EPOCH : 56

Training loss : 0.0732740911302977

Training accuracy : 99.17726252804786%

Validation loss : 0.13844136313831867

Validation accuracy: 97.44356812618983%

----------------------------------------------------

[57, 100] loss: 0.000

[57, 200] loss: 0.001

EPOCH : 57

Training loss : 0.06901321747029525

Training accuracy : 99.33365064255116%

Validation loss : 0.13587239049912017

Validation accuracy: 97.17160728855045%

----------------------------------------------------

[58, 100] loss: 0.001

[58, 200] loss: 0.000

EPOCH : 58

Training loss : 0.06630983025680597

Training accuracy : 99.354049092269%

Validation loss : 0.12184186321514795

Validation accuracy: 97.74272504759314%

----------------------------------------------------

[59, 100] loss: 0.001

[59, 200] loss: 0.001

EPOCH : 59

Training loss : 0.05847649465826647

Training accuracy : 99.56483307268648%

Validation loss : 0.13531400504435148

Validation accuracy: 97.66113679630134%

----------------------------------------------------

[60, 100] loss: 0.000

[60, 200] loss: 0.001

EPOCH : 60

Training loss : 0.07085313185509425

Training accuracy : 99.36084857550826%

Validation loss : 0.12513721835396036

Validation accuracy: 97.79711721512102%

----------------------------------------------------

[61, 100] loss: 0.001

[61, 200] loss: 0.001

EPOCH : 61

Training loss : 0.06476105626097768

Training accuracy : 99.37444754198681%

Validation loss : 0.13873852761439534

Validation accuracy: 97.68833288006527%

----------------------------------------------------

[62, 100] loss: 0.000

[62, 200] loss: 0.001

EPOCH : 62

Training loss : 0.06704337599162882

Training accuracy : 99.34724960902972%

Validation loss : 0.12568990640222685

Validation accuracy: 97.82431329888496%

----------------------------------------------------

GroundTruth: கு ගූ ங் சி ங் ச ஓ ஐ ஙி ගෑ

Predicted: கு ගූ ක් சி ங் ச ஒ ஐ ங ගෑ

Accuracy of the network on the test images: 92.069657 %

Non-normalized Confusion Matrix

Confusion Matrix for Test Set

[[31 0 0 ... 0 0 0]

[ 0 44 0 ... 0 0 0]

[ 0 0 40 ... 0 0 0]

...

[ 0 2 0 ... 44 0 0]

[ 0 0 0 ... 0 43 0]

[ 7 0 2 ... 0 0 53]]

Classification report

precision recall f1-score support

0 0.94 0.80 0.86 60

1 0.79 1.00 0.88 48

2 0.86 0.76 0.81 63

3 0.81 0.81 0.81 54

4 0.74 0.88 0.80 56

5 0.60 0.95 0.74 43

6 0.81 0.98 0.89 44

7 0.89 0.72 0.80 69

8 0.84 0.86 0.85 81

9 0.82 0.93 0.87 71

10 0.98 0.69 0.81 89

11 0.83 0.81 0.82 111

12 0.96 0.96 0.96 118

13 0.94 0.77 0.85 118

14 0.90 0.90 0.90 91

15 0.80 0.82 0.81 110

16 0.79 0.84 0.81 109

17 0.69 0.77 0.73 96

18 0.90 0.66 0.76 104

19 0.94 0.91 0.92 96

20 0.81 0.87 0.84 124

21 0.90 0.71 0.79 134

22 0.90 0.75 0.82 122

23 0.71 0.95 0.81 37

24 0.81 0.88 0.84 43

25 0.70 0.92 0.80 49

26 0.79 0.82 0.80 50

27 0.80 0.74 0.77 50

28 0.76 0.84 0.80 57

29 0.49 0.90 0.63 41

30 0.90 0.73 0.81 64

31 0.96 0.96 0.96 180

32 0.99 0.99 0.99 180

33 1.00 0.99 0.99 180

34 0.97 0.93 0.95 180

35 1.00 0.98 0.99 180

36 0.98 1.00 0.99 180

37 0.99 0.99 0.99 180

38 0.94 0.97 0.96 180

39 0.98 0.97 0.97 180

40 0.99 0.98 0.99 180

41 0.83 0.87 0.85 180

42 0.89 0.85 0.87 180

43 1.00 0.99 0.99 180

44 0.99 0.99 0.99 180

45 0.96 0.96 0.96 180

46 0.94 0.93 0.93 180

47 0.91 0.96 0.93 180

48 0.96 0.91 0.93 180

49 0.93 0.96 0.95 180

50 0.99 0.99 0.99 180

51 0.98 0.94 0.96 180

52 0.97 0.96 0.96 180

53 0.96 0.95 0.96 180

54 0.87 0.97 0.92 180

55 0.98 0.98 0.98 180

56 0.98 0.97 0.98 180

57 0.97 0.97 0.97 180

58 0.95 0.98 0.96 180

59 0.99 0.98 0.99 180

60 0.99 0.98 0.99 180

61 0.99 0.98 0.99 180

accuracy 0.92 7982

macro avg 0.89 0.90 0.89 7982

weighted avg 0.93 0.92 0.92 7982

Training completed! Trained model saved to: ../ds\_trained/SinhalaTamil\_CNN\_Trained.pt