ATS_Ver_3(last_version)

February 8, 2022

[ ]:
```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

1 Thư viện

[ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from tqdm import tqdm
import argparse
import os
import sys
import math

from sklearn import metrics
from sklearn.metrics import precision_score

from sklearn.linear_model import LogisticRegression
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
from sklearn.naive_bayes import GaussianNB
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.ensemble import AdaBoostClassifier
from xgboost import XGBClassifier
from lightgbm import LGBMClassifier

from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense

from tensorflow.keras.metrics import Accuracy

from keras.callbacks import EarlyStopping
from keras.models import Sequential
```

```
from keras.layers import LSTM
from keras.layers import Dense
from keras.layers import TimeDistributed
from keras.layers import RepeatVector
from keras.layers import Dropout

from tensorflow.keras.models import Model
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.callbacks import ModelCheckpoint, ReduceLROnPlateau,␣
↪TensorBoard, CSVLogger, EarlyStopping

import tensorflow as tf
from tensorflow.compat.v1.keras.backend import set_session
```

2 Import code

[ ]:
```
from google.colab import files
src = list(files.upload().values())[0]

open('augmentation.py','wb').write(src)
import augmentation as augmentation
```

```
<IPython.core.display.HTML object>
```

```
Saving augmentation.py to augmentation.py
```

3 Import data

[ ]:
```
df_test = pd.read_csv('/content/drive/MyDrive/Colab Notebooks/Subject/Chuỗi␣
↪thời gian/Cuối kỳ/CBF_TEST.csv')

df_train = pd.read_csv('/content/drive/MyDrive/Colab Notebooks/Subject/Chuỗi␣
↪thời gian/Cuối kỳ/CBF_TRAIN.csv')
```

[ ]:
```
df_train
```

[ ]:
```
     Label        A1        A2        A3  …      A125      A126      A127
A128
0        1 -0.464276 -0.555048 -0.842843  … -0.789362 -0.638706 -0.963664
-1.245169
1        1 -0.896972 -0.685686 -1.351382  … -0.916523 -0.582098 -1.259009
-1.392524
2        1 -0.464696 -0.567739 -0.032023  … -0.865315 -0.284486 -0.687889
-0.887608
3        3 -0.187190 -0.620808 -0.815661  … -0.587889 -0.608232 -0.636465
```

```
-0.349029
4       2 -1.136017 -1.319195 -1.844624  … -0.953538 -1.270185 -1.742758
-0.925944
5       2 -0.568709 -0.888118 -0.047977  … -0.101093 -0.233949 -0.619827
-0.083062
6       1 -0.965839 -1.644583 -1.805935  … -1.133566 -0.610344 -1.165220
-0.685899
7       3 -0.264302 -0.290925 -0.598567  …  0.192093 -1.443154 -1.039481
-0.631209
8       2 -0.803716 -0.048161 -1.299278  … -0.864444 -0.706192 -1.388656
-0.650710
9       1 -1.186422 -0.893197 -0.977737  … -0.810800 -0.981591 -1.278444
-1.107829
10      2 -0.653308 -1.295185 -0.457384  … -0.332990  0.548204 -0.596229
-0.190672
11      2 -0.541876 -1.016107 -1.079902  … -0.564348 -0.314559 -1.110768
0.105266
12      1 -1.945327 -1.449840 -1.488946  …  0.926008 -1.941053 -2.111237
-1.768088
13      2  0.045628 -1.129965 -0.520607  … -0.000054 -1.409262 -0.781512
-0.618237
14      2 -0.413197 -0.400935 -0.482027  … -1.058378 -0.410209 -1.027981
-0.549934
15      3 -1.659120 -1.001310  0.342287  … -1.554400 -1.516667  0.113708
-1.006452
16      2 -0.725354 -0.837863 -1.013462  … -0.805372 -0.801574 -0.612442
-1.022886
17      2 -1.457541 -0.668126 -1.111360  … -0.135961 -0.715323 -0.719066
-1.201701
18      1 -1.411368 -1.208220 -0.681907  … -1.742469 -1.161046 -0.964383
-1.316116
19      3 -0.927105 -0.648515 -0.172875  … -1.110569 -0.872846  0.129311
-0.142658
20      2 -1.451680 -1.445272 -1.073598  …  0.984469  1.229552  0.839711
-0.415842
21      2 -0.534452 -0.954354 -0.806711  … -0.472178 -0.640636 -0.942633
-1.462932
22      1 -1.086040 -1.199305 -1.120579  … -1.363522 -1.527203 -1.052013
-0.905395
23      1 -1.676169 -1.839363 -1.833647  … -0.074705  0.349369  0.598850
0.153169
24      3 -1.314889 -1.350861 -0.574819  … -0.189025 -1.576739 -0.834170
-0.757507
25      3 -0.190921 -0.616051 -0.598029  …  0.203783 -0.771398 -0.335743
-0.471972
26      2 -0.191813 -0.046090 -1.365237  … -0.740407  0.079962 -0.644739
-0.699253
```

```
27      3 -0.180493 -0.988931 -0.301702  … -0.799767  0.019760 -0.942132
0.013121
28      3 -0.265888  0.013128 -1.028861  … -1.349964 -0.405544 -0.930632
-0.777303
29      1 -0.993315 -0.869419 -0.345135  … -1.225446 -1.170861 -1.325109
-0.894582

[30 rows x 129 columns]
```

Chia dữ liệu

[ ]:
```
features = df_train.columns[1:]
```

[ ]:
```
df_train_X = df_train[features]
df_test_X = df_test[features]

y_train = df_train['Label'].values
y_test = df_test['Label'].values
```

[ ]:
```
nb_dims = 1
x_train = df_train_X.values
x_test = df_test_X.values

nb_timesteps = int(x_train.shape[1] / nb_dims)
input_shape = (nb_timesteps , nb_dims)

x_train_max = np.max(x_train)
x_train_min = np.min(x_train)
x_train = 2. * (x_train - x_train_min) / (x_train_max - x_train_min) - 1.
# Test is secret
x_test = 2. * (x_test - x_train_min) / (x_train_max - x_train_min) - 1.

x_test = x_test.reshape((-1, input_shape[0], input_shape[1]))
x_train = x_train.reshape((-1, input_shape[0], input_shape[1]))
```

[ ]:
```
x_train
```

[ ]:
```
array([[[-0.33377329],
        [-0.36641649],
        [-0.46991339],
        …,
        [-0.39650156],
        [-0.51336308],
        [-0.61459784]],

       [[-0.48937925],
        [-0.41339639],
```

```
        [-0.65279404],
        …,
        [-0.37614427],
        [-0.61957508],
        [-0.66758963]],

       [[-0.33392414],
        [-0.37098044],
        [-0.17832623],
        …,
        [-0.26911694],
        [-0.41418885],
        [-0.48601186]],

       …,

       [[-0.23171899],
        [-0.52244956],
        [-0.27530829],
        …,
        [-0.15970429],
        [-0.50561979],
        [-0.16209173]],

       [[-0.26242889],
        [-0.16208914],
        [-0.53680928],
        …,
        [-0.31265203],
        [-0.50148404],
        [-0.44634377]],

       [[-0.52402617],
        [-0.47947077],
        [-0.29092775],
        …,
        [-0.58787498],
        [-0.64334596],
        [-0.48851986]]])
```

Đưa dữ liệu 3D về 2D

[ ]:
```
# x_test = x_test.reshape(300,128)
x_test = x_test.reshape(900,128)
```

Y_new

[ ]:
```
# 10
y_train_new = y_train

for i in range(0,99):
  y_train_new = np.append(y_train_new, y_train)
```

[ ]:
```
y_train_new.shape
```

[ ]:
```
(3000,)
```

4 12 Phương pháp sinh dữ liệu

Hàm bổ trợ

[ ]:
```
import numpy as np
import math
import sys

RETURN_VALUE = 0
RETURN_PATH = 1
RETURN_ALL = -1

# Core DTW
def _traceback(DTW, slope_constraint):
    i, j = np.array(DTW.shape) - 1
    p, q = [i-1], [j-1]

    if slope_constraint == "asymmetric":
        while (i > 1):
            tb = np.argmin((DTW[i-1, j], DTW[i-1, j-1], DTW[i-1, j-2]))

            if (tb == 0):
                i = i - 1
            elif (tb == 1):
                i = i - 1
                j = j - 1
            elif (tb == 2):
                i = i - 1
                j = j - 2

            p.insert(0, i-1)
            q.insert(0, j-1)
    elif slope_constraint == "symmetric":
        while (i > 1 or j > 1):
            tb = np.argmin((DTW[i-1, j-1], DTW[i-1, j], DTW[i, j-1]))

            if (tb == 0):
```

```
                i = i - 1
                j = j - 1
            elif (tb == 1):
                i = i - 1
            elif (tb == 2):
                j = j - 1

            p.insert(0, i-1)
            q.insert(0, j-1)
    else:
        sys.exit("Unknown slope constraint %s"%slope_constraint)

    return (np.array(p), np.array(q))

def _cummulative_matrix(cost, slope_constraint, window):
    p = cost.shape[0]
    s = cost.shape[1]

    # Note: DTW is one larger than cost and the original patterns
    DTW = np.full((p+1, s+1), np.inf)

    DTW[0, 0] = 0.0

    if slope_constraint == "asymmetric":
        for i in range(1, p+1):
            if i <= window+1:
                DTW[i,1] = cost[i-1,0] + min(DTW[i-1,0], DTW[i-1,1])
            for j in range(max(2, i-window), min(s, i+window)+1):
                DTW[i,j] = cost[i-1,j-1] + min(DTW[i-1,j-2], DTW[i-1,j-1],␣
↪DTW[i-1,j])
    elif slope_constraint == "symmetric":
        for i in range(1, p+1):
            for j in range(max(1, i-window), min(s, i+window)+1):
                DTW[i,j] = cost[i-1,j-1] + min(DTW[i-1,j-1], DTW[i,j-1],␣
↪DTW[i-1,j])
    else:
        sys.exit("Unknown slope constraint %s"%slope_constraint)

    return DTW

def shape_dtw(prototype, sample, return_flag = RETURN_VALUE,␣
↪slope_constraint="asymmetric", window=None, descr_ratio=0.05):
    """ Computes the shapeDTW of two sequences.
    :param prototype: np array [0..b]
    :param sample: np array [0..t]
    :param extended: bool
    """
```

```
    # shapeDTW
    # https://www.sciencedirect.com/science/article/pii/S0031320317303710

    p = prototype.shape[0]
    assert p != 0, "Prototype empty!"
    s = sample.shape[0]
    assert s != 0, "Sample empty!"

    if window is None:
        window = s

    p_feature_len = np.clip(np.round(p * descr_ratio), 5, 100).astype(int)
    s_feature_len = np.clip(np.round(s * descr_ratio), 5, 100).astype(int)

    # padding
    p_pad_front = (np.ceil(p_feature_len / 2.)).astype(int)
    p_pad_back = (np.floor(p_feature_len / 2.)).astype(int)
    s_pad_front = (np.ceil(s_feature_len / 2.)).astype(int)
    s_pad_back = (np.floor(s_feature_len / 2.)).astype(int)

    prototype_pad = np.pad(prototype, ((p_pad_front, p_pad_back), (0, 0)),␣
↪mode="edge")
    sample_pad = np.pad(sample, ((s_pad_front, s_pad_back), (0, 0)),␣
↪mode="edge")
    p_p = prototype_pad.shape[0]
    s_p = sample_pad.shape[0]

    cost = np.full((p, s), np.inf)
    for i in range(p):
        for j in range(max(0, i-window), min(s, i+window)):
            cost[i, j] = np.linalg.norm(sample_pad[j:j+s_feature_len] -␣
↪prototype_pad[i:i+p_feature_len])

    DTW = _cummulative_matrix(cost, slope_constraint=slope_constraint,␣
↪window=window)

    if return_flag == RETURN_ALL:
        return DTW[-1,-1], cost, DTW[1:,1:], _traceback(DTW, slope_constraint)
    elif return_flag == RETURN_PATH:
        return _traceback(DTW, slope_constraint)
    else:
        return DTW[-1,-1]

# Draw helpers
def draw_graph2d(cost, DTW, path, prototype, sample):
    import matplotlib.pyplot as plt
    plt.figure(figsize=(12, 8))
```

```
   # plt.subplots_adjust(left=.02, right=.98, bottom=.001, top=.96, wspace=.05,␣
↪hspace=.01)

    #cost
    plt.subplot(2, 3, 1)
    plt.imshow(cost.T, cmap=plt.cm.gray, interpolation='none', origin='lower')
    plt.plot(path[0], path[1], 'y')
    plt.xlim((-0.5, cost.shape[0]-0.5))
    plt.ylim((-0.5, cost.shape[0]-0.5))

    #dtw
    plt.subplot(2, 3, 2)
    plt.imshow(DTW.T, cmap=plt.cm.gray, interpolation='none', origin='lower')
    plt.plot(path[0]+1, path[1]+1, 'y')
    plt.xlim((-0.5, DTW.shape[0]-0.5))
    plt.ylim((-0.5, DTW.shape[0]-0.5))

    #prototype
    plt.subplot(2, 3, 4)
    plt.plot(prototype[:,0], prototype[:,1], 'b-o')

    #connection
    plt.subplot(2, 3, 5)
    for i in range(0,path[0].shape[0]):
        plt.plot([prototype[path[0][i],0],␣
↪sample[path[1][i],0]],[prototype[path[0][i],1], sample[path[1][i],1]], 'y-')
    plt.plot(sample[:,0], sample[:,1], 'g-o')
    plt.plot(prototype[:,0], prototype[:,1], 'b-o')

    #sample
    plt.subplot(2, 3, 6)
    plt.plot(sample[:,0], sample[:,1], 'g-o')

    plt.tight_layout()
    plt.show()

def draw_graph1d(cost, DTW, path, prototype, sample):
    import matplotlib.pyplot as plt
    plt.figure(figsize=(12, 8))
   # plt.subplots_adjust(left=.02, right=.98, bottom=.001, top=.96, wspace=.05,␣
↪hspace=.01)
    p_steps = np.arange(prototype.shape[0])
    s_steps = np.arange(sample.shape[0])

    #cost
    plt.subplot(2, 3, 1)
    plt.imshow(cost.T, cmap=plt.cm.gray, interpolation='none', origin='lower')
```

```
    plt.plot(path[0], path[1], 'y')
    plt.xlim((-0.5, cost.shape[0]-0.5))
    plt.ylim((-0.5, cost.shape[0]-0.5))

    #dtw
    plt.subplot(2, 3, 2)
    plt.imshow(DTW.T, cmap=plt.cm.gray, interpolation='none', origin='lower')
    plt.plot(path[0]+1, path[1]+1, 'y')
    plt.xlim((-0.5, DTW.shape[0]-0.5))
    plt.ylim((-0.5, DTW.shape[0]-0.5))

    #prototype
    plt.subplot(2, 3, 4)
    plt.plot(p_steps, prototype[:,0], 'b-o')

    #connection
    plt.subplot(2, 3, 5)
    for i in range(0,path[0].shape[0]):
        plt.plot([path[0][i], path[1][i]],[prototype[path[0][i],0],␣
↪sample[path[1][i],0]], 'y-')
    plt.plot(p_steps, sample[:,0], 'g-o')
    plt.plot(s_steps, prototype[:,0], 'b-o')

    #sample
    plt.subplot(2, 3, 6)
    plt.plot(s_steps, sample[:,0], 'g-o')

    plt.tight_layout()
    plt.show()
```

[ ]:
```
def dtw(prototype, sample, return_flag = 0, slope_constraint="asymmetric",␣
↪window=None):
    """ Computes the DTW of two sequences.
    :param prototype: np array [0..b]
    :param sample: np array [0..t]
    :param extended: bool
    """
    p = prototype.shape[0]
    assert p != 0, "Prototype empty!"
    s = sample.shape[0]
    assert s != 0, "Sample empty!"

    if window is None:
        window = s

    cost = np.full((p, s), np.inf)
    for i in range(p):
```

```
        start = max(0, i-window)
        end = min(s, i+window)+1
        cost[i,start:end]=np.linalg.norm(sample[start:end] - prototype[i],␣
↪axis=1)

    DTW = _cummulative_matrix(cost, slope_constraint, window)

    if return_flag == RETURN_ALL:
        return DTW[-1,-1], cost, DTW[1:,1:], _traceback(DTW, slope_constraint)
    elif return_flag == RETURN_PATH:
        return _traceback(DTW, slope_constraint)
    else:
        return DTW[-1,-1]
```

spawner

[ ]:
```
def spawner(x, labels, sigma=0.05, verbose=0):
    # https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6983028/
    # use verbose=-1 to turn off warnings
    # use verbose=1 to print out figures

   # import dtw as dtw
    random_points = np.random.randint(low=1, high=x.shape[1]-1, size=x.shape[0])
    window = np.ceil(x.shape[1] / 10.).astype(int)
    orig_steps = np.arange(x.shape[1])
    l = np.argmax(labels, axis=1) if labels.ndim > 1 else labels

    ret = np.zeros_like(x)
    for i, pat in enumerate(tqdm(x)):
        # guarentees that same one isnt selected
        choices = np.delete(np.arange(x.shape[0]), i)
        # remove ones of different classes
        choices = np.where(l[choices] == l[i])[0]
        if choices.size > 0:
            random_sample = x[np.random.choice(choices)]
            # SPAWNER splits the path into two randomly
            path1 = dtw(pat[:random_points[i]], random_sample[:
↪random_points[i]], RETURN_PATH, slope_constraint="symmetric", window=window)
            path2 = dtw(pat[random_points[i]:], random_sample[random_points[i]:
↪], RETURN_PATH, slope_constraint="symmetric", window=window)
            combined = np.concatenate((np.vstack(path1), np.
↪vstack(path2+random_points[i])), axis=1)
            if verbose:
                print(random_points[i])
                dtw_value, cost, DTW_map, path = dtw(pat, random_sample,␣
↪return_flag = RETURN_ALL, slope_constraint="symmetric", window=window)
                draw_graph1d(cost, DTW_map, path, pat, random_sample)
```

```
                draw_graph1d(cost, DTW_map, combined, pat, random_sample)
            mean = np.mean([pat[combined[0]], random_sample[combined[1]]],␣
↪axis=0)
            for dim in range(x.shape[2]):
                ret[i,:,dim] = np.interp(orig_steps, np.linspace(0, x.
↪shape[1]-1., num=mean.shape[0]), mean[:,dim]).T
        else:
            if verbose > -1:
                print("There is only one pattern of class %d, skipping pattern␣
↪average"%l[i])
            ret[i,:] = pat
    return augmentation.jitter(ret, sigma=sigma)
```

wdba

[ ]:
```
def wdba(x, labels, batch_size=6, slope_constraint="symmetric",␣
↪use_window=True, verbose=0):
    # https://ieeexplore.ieee.org/document/8215569
    # use verbose = -1 to turn off warnings
    # slope_constraint is for DTW. "symmetric" or "asymmetric"

    if use_window:
        window = np.ceil(x.shape[1] / 10.).astype(int)
    else:
        window = None
    orig_steps = np.arange(x.shape[1])
    l = np.argmax(labels, axis=1) if labels.ndim > 1 else labels

    ret = np.zeros_like(x)
    for i in tqdm(range(ret.shape[0])):
        # get the same class as i
        choices = np.where(l == l[i])[0]
        if choices.size > 0:
            # pick random intra-class pattern
            k = min(choices.size, batch_size)
            random_prototypes = x[np.random.choice(choices, k, replace=False)]

            # calculate dtw between all
            dtw_matrix = np.zeros((k, k))
            for p, prototype in enumerate(random_prototypes):
                for s, sample in enumerate(random_prototypes):
                    if p == s:
                        dtw_matrix[p, s] = 0.
                    else:
                        dtw_matrix[p, s] = dtw(prototype, sample, RETURN_VALUE,␣
↪slope_constraint=slope_constraint, window=window)
```

```
            # get medoid
            medoid_id = np.argsort(np.sum(dtw_matrix, axis=1))[0]
            nearest_order = np.argsort(dtw_matrix[medoid_id])
            medoid_pattern = random_prototypes[medoid_id]

            # start weighted DBA
            average_pattern = np.zeros_like(medoid_pattern)
            weighted_sums = np.zeros((medoid_pattern.shape[0]))
            for nid in nearest_order:
                if nid == medoid_id or dtw_matrix[medoid_id, nearest_order[1]]␣
↪== 0.:
                    average_pattern += medoid_pattern
                    weighted_sums += np.ones_like(weighted_sums)
                else:
                    path = dtw(medoid_pattern, random_prototypes[nid],␣
↪RETURN_PATH, slope_constraint=slope_constraint, window=window)
                    dtw_value = dtw_matrix[medoid_id, nid]
                    warped = random_prototypes[nid, path[1]]
                    weight = np.exp(np.log(0.5)*dtw_value/dtw_matrix[medoid_id,␣
↪nearest_order[1]])
                    average_pattern[path[0]] += weight * warped
                    weighted_sums[path[0]] += weight

            ret[i,:] = average_pattern / weighted_sums[:,np.newaxis]
        else:
            if verbose > -1:
                print("There is only one pattern of class %d, skipping pattern␣
↪average"%l[i])
            ret[i,:] = x[i]
    return ret
```

random_guided_warp

[ ]:
```
def random_guided_warp(x, labels, slope_constraint="symmetric",␣
↪use_window=True, dtw_type="normal", verbose=0):
    # use verbose = -1 to turn off warnings
    # slope_constraint is for DTW. "symmetric" or "asymmetric"
    # dtw_type is for shapeDTW or DTW. "normal" or "shape"

    if use_window:
        window = np.ceil(x.shape[1] / 10.).astype(int)
    else:
        window = None
    orig_steps = np.arange(x.shape[1])
    l = np.argmax(labels, axis=1) if labels.ndim > 1 else labels

    ret = np.zeros_like(x)
```

```
    for i, pat in enumerate(tqdm(x)):
        # guarentees that same one isnt selected
        choices = np.delete(np.arange(x.shape[0]), i)
        # remove ones of different classes
        choices = np.where(l[choices] == l[i])[0]
        if choices.size > 0:
            # pick random intra-class pattern
            random_prototype = x[np.random.choice(choices)]

            if dtw_type == "shape":
                path = shape_dtw(random_prototype, pat, RETURN_PATH,␣
↪slope_constraint=slope_constraint, window=window)
            else:
                path = dtw(random_prototype, pat, RETURN_PATH,␣
↪slope_constraint=slope_constraint, window=window)

            # Time warp
            warped = pat[path[1]]
            for dim in range(x.shape[2]):
                ret[i,:,dim] = np.interp(orig_steps, np.linspace(0, x.
↪shape[1]-1., num=warped.shape[0]), warped[:,dim]).T
        else:
            if verbose > -1:
                print("There is only one pattern of class %d, skipping␣
↪timewarping"%l[i])
            ret[i,:] = pat
    return ret
```

discriminative_guided_warp

[ ]:
```
def discriminative_guided_warp(x, labels, batch_size=6,␣
↪slope_constraint="symmetric", use_window=True, dtw_type="normal",␣
↪use_variable_slice=True, verbose=0):
    # use verbose = -1 to turn off warnings
    # slope_constraint is for DTW. "symmetric" or "asymmetric"
    # dtw_type is for shapeDTW or DTW. "normal" or "shape"

    if use_window:
        window = np.ceil(x.shape[1] / 10.).astype(int)
    else:
        window = None
    orig_steps = np.arange(x.shape[1])
    l = np.argmax(labels, axis=1) if labels.ndim > 1 else labels

    positive_batch = np.ceil(batch_size / 2).astype(int)
    negative_batch = np.floor(batch_size / 2).astype(int)
```

```
    ret = np.zeros_like(x)
    warp_amount = np.zeros(x.shape[0])
    for i, pat in enumerate(tqdm(x)):
        # guarentees that same one isnt selected
        choices = np.delete(np.arange(x.shape[0]), i)

        # remove ones of different classes
        positive = np.where(l[choices] == l[i])[0]
        negative = np.where(l[choices] != l[i])[0]

        if positive.size > 0 and negative.size > 0:
            pos_k = min(positive.size, positive_batch)
            neg_k = min(negative.size, negative_batch)
            positive_prototypes = x[np.random.choice(positive, pos_k,␣
↪replace=False)]
            negative_prototypes = x[np.random.choice(negative, neg_k,␣
↪replace=False)]

            # vector embedding and nearest prototype in one
            pos_aves = np.zeros((pos_k))
            neg_aves = np.zeros((pos_k))
            if dtw_type == "shape":
                for p, pos_prot in enumerate(positive_prototypes):
                    for ps, pos_samp in enumerate(positive_prototypes):
                        if p != ps:
                            pos_aves[p] += (1./(pos_k-1.))*shape_dtw(pos_prot,␣
↪pos_samp, RETURN_VALUE, slope_constraint=slope_constraint, window=window)
                    for ns, neg_samp in enumerate(negative_prototypes):
                        neg_aves[p] += (1./neg_k)*shape_dtw(pos_prot, neg_samp,␣
↪RETURN_VALUE, slope_constraint=slope_constraint, window=window)
                selected_id = np.argmax(neg_aves - pos_aves)
                path = shape_dtw(positive_prototypes[selected_id], pat,␣
↪RETURN_PATH, slope_constraint=slope_constraint, window=window)
            else:
                for p, pos_prot in enumerate(positive_prototypes):
                    for ps, pos_samp in enumerate(positive_prototypes):
                        if p != ps:
                            pos_aves[p] += (1./(pos_k-1.))*dtw(pos_prot,␣
↪pos_samp, RETURN_VALUE, slope_constraint=slope_constraint, window=window)
                    for ns, neg_samp in enumerate(negative_prototypes):
                        neg_aves[p] += (1./neg_k)*dtw(pos_prot, neg_samp,␣
↪RETURN_VALUE, slope_constraint=slope_constraint, window=window)
                selected_id = np.argmax(neg_aves - pos_aves)
                path = dtw(positive_prototypes[selected_id], pat, RETURN_PATH,␣
↪slope_constraint=slope_constraint, window=window)
```

```
            # Time warp
            warped = pat[path[1]]
            warp_path_interp = np.interp(orig_steps, np.linspace(0, x.
↪shape[1]-1., num=warped.shape[0]), path[1])
            warp_amount[i] = np.sum(np.abs(orig_steps-warp_path_interp))
            for dim in range(x.shape[2]):
                ret[i,:,dim] = np.interp(orig_steps, np.linspace(0, x.
↪shape[1]-1., num=warped.shape[0]), warped[:,dim]).T
        else:
            if verbose > -1:
                print("There is only one pattern of class %d"%l[i])
            ret[i,:] = pat
            warp_amount[i] = 0.
    if use_variable_slice:
        max_warp = np.max(warp_amount)
        if max_warp == 0:
            # unchanged
            ret = augmentation.window_slice(ret, reduce_ratio=0.9)
        else:
            for i, pat in enumerate(ret):
                # Variable Sllicing
                ret[i] = augmentation.window_slice(pat[np.newaxis,:,:],␣
↪reduce_ratio=0.9+0.1*warp_amount[i]/max_warp)[0]
    return ret
```

4.1 Hàm áp dụng dữ liệu sinh từ 12 Phương pháp lần lượt vào mô hình MÁY HỌC

[ ]:
```
def method_apply(model, x_train, y_train, x_test, y_test):

  # Khong ap dung Sinh du lieu
  model.fit(x_train.reshape(30,128), y_train)
  y_pred = model.predict(x_test)
  print("Accuracy - None:",metrics.accuracy_score(y_pred,y_test))

  # Ap dung PP jitter
  x_train_jitter = x_train
  for i in range(0, 99):
    tmp1 = augmentation.jitter(x_train)
    x_train_jitter = np.append(x_train_jitter, tmp1, axis = 0)
  model.fit(x_train_jitter.reshape(3000,128), y_train_new)
  y_pred = model.predict(x_test)
  print("Accuracy - jitter:",metrics.accuracy_score(y_pred,y_test))

  # Ap dung PP scaling
  x_train_scaling = x_train
```

```
for i in range(0, 99):
  tmp1 = augmentation.scaling(x_train)
  x_train_scaling = np.append(x_train_scaling, tmp1, axis = 0)
model.fit(x_train_scaling.reshape(3000,128), y_train_new)
y_pred = model.predict(x_test)
print("Accuracy - scaling:",metrics.accuracy_score(y_pred,y_test))

# Ap dung PP rotation
x_train_rotation = x_train
for i in range(0, 99):
  tmp1 = augmentation.rotation(x_train)
  x_train_rotation = np.append(x_train_rotation, tmp1, axis = 0)
model.fit(x_train_rotation.reshape(3000,128), y_train_new)
y_pred = model.predict(x_test)
print("Accuracy - rotation:",metrics.accuracy_score(y_pred,y_test))

#Ap dung PP permutation
x_train_permutation = x_train
for i in range(0, 99):
  tmp1 = augmentation.permutation(x_train)
  x_train_permutation = np.append(x_train_permutation, tmp1, axis = 0)
model.fit(x_train_permutation.reshape(3000,128), y_train_new)
y_pred = model.predict(x_test)
print("Accuracy - permutation:",metrics.accuracy_score(y_pred,y_test))

# Ap dung PP magnitude_warp
x_train_magnitude_warp = x_train
for i in range(0, 99):
  tmp1 = augmentation.magnitude_warp(x_train)
  x_train_magnitude_warp = np.append(x_train_magnitude_warp, tmp1, axis = 0)
model.fit(x_train_magnitude_warp.reshape(3000,128), y_train_new)
y_pred = model.predict(x_test)
print("Accuracy - magnitude_warp:",metrics.accuracy_score(y_pred,y_test))

# Ap dung PP time_warp
x_train_time_warp = x_train
for i in range(0, 99):
  tmp1 = augmentation.time_warp(x_train)
  x_train_time_warp = np.append(x_train_time_warp, tmp1, axis = 0)
model.fit(x_train_time_warp.reshape(3000,128), y_train_new)
y_pred = model.predict(x_test)
print("Accuracy - time_warp:",metrics.accuracy_score(y_pred,y_test))

# Ap dung PP window_slice
x_train_window_slice = x_train
for i in range(0, 99):
  tmp1 = augmentation.window_slice(x_train)
```

```
  x_train_window_slice = np.append(x_train_window_slice, tmp1, axis = 0)
model.fit(x_train_window_slice.reshape(3000,128), y_train_new)
y_pred = model.predict(x_test)
print("Accuracy - window_slice:",metrics.accuracy_score(y_pred,y_test))

# Ap dung PP window_warp
x_train_window_warp = x_train
for i in range(0, 99):
  tmp1 = augmentation.window_warp(x_train)
  x_train_window_warp = np.append(x_train_window_warp, tmp1, axis = 0)
model.fit(x_train_window_warp.reshape(3000,128), y_train_new)
y_pred = model.predict(x_test)
print("Accuracy - window_warp:",metrics.accuracy_score(y_pred,y_test))

# Ap dung PP spawner
x_train_spawner = x_train
for i in range(0, 99):
  tmp1 = spawner(x_train, y_train)
  x_train_spawner = np.append(x_train_spawner, tmp1, axis = 0)
model.fit(x_train_spawner.reshape(3000,128), y_train_new)
y_pred = model.predict(x_test)
print("Accuracy - spawner:",metrics.accuracy_score(y_pred,y_test))

# Ap dung PP wdba
x_train_wdba = x_train
for i in range(0, 99):
  tmp1 = wdba(x_train, y_train)
  x_train_wdba = np.append(x_train_wdba, tmp1, axis = 0)
model.fit(x_train_wdba.reshape(3000,128), y_train_new)
y_pred = model.predict(x_test)
print("Accuracy - wdba:",metrics.accuracy_score(y_pred,y_test))

# Ap dung PP random_guided_warp
x_train_random_guided_warp = x_train
for i in range(0, 99):
  tmp1 = random_guided_warp(x_train, y_train)
  x_train_random_guided_warp = np.append(x_train_random_guided_warp, tmp1,␣
↪axis = 0)
model.fit(x_train_random_guided_warp.reshape(3000,128), y_train_new)
y_pred = model.predict(x_test)
print("Accuracy - random_guided_warp:",metrics.accuracy_score(y_pred,y_test))

# Ap dung PP discriminative_guided_warp
x_train_discriminative_guided_warp = x_train
for i in range(0, 99):
  tmp1 = discriminative_guided_warp(x_train, y_train)
```

```
   x_train_discriminative_guided_warp = np.
↪append(x_train_discriminative_guided_warp, tmp1, axis = 0)
 model.fit(x_train_discriminative_guided_warp.reshape(3000,128), y_train_new)
 y_pred = model.predict(x_test)
 print("Accuracy - discriminative_guided_warp:",metrics.
↪accuracy_score(y_pred,y_test))
```

5 Các mô hình Machine Learning cơ bản

Logistic Regression

[ ]:
```
logreg = LogisticRegression(fit_intercept=True, penalty='l2')
method_apply(logreg, x_train, y_train, x_test, y_test)
```

```
Accuracy - None: 0.8533333333333334
Accuracy - jitter: 0.8544444444444445
Accuracy - scaling: 0.8433333333333334
Accuracy - rotation: 0.45666666666666667

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray
/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_logistic.py:818:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  extra_warning_msg=_LOGISTIC_SOLVER_CONVERGENCE_MSG,

Accuracy - permutation: 0.3377777777777778
Accuracy - magnitude_warp: 0.86

/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_logistic.py:818:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
```

```
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  extra_warning_msg=_LOGISTIC_SOLVER_CONVERGENCE_MSG,

Accuracy - time_warp: 0.7477777777777778

/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_logistic.py:818:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  extra_warning_msg=_LOGISTIC_SOLVER_CONVERGENCE_MSG,

Accuracy - window_slice: 0.95

/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_logistic.py:818:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  extra_warning_msg=_LOGISTIC_SOLVER_CONVERGENCE_MSG,

Accuracy - window_warp: 0.8888888888888888

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100%|      | 30/30 [00:00<00:00, 104.34it/s]
100%|      | 30/30 [00:00<00:00, 94.23it/s]
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100%|      | 30/30 [00:00<00:00, 101.47it/s]
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```

```
100%|      | 30/30 [00:00<00:00, 94.02it/s]
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100%|      | 30/30 [00:00<00:00, 102.29it/s]
100%|      | 30/30 [00:00<00:00, 96.89it/s]
100%|      | 30/30 [00:00<00:00, 107.02it/s]
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100%|      | 30/30 [00:00<00:00, 103.10it/s]
100%|      | 30/30 [00:00<00:00, 115.10it/s]
100%|      | 30/30 [00:00<00:00, 97.77it/s]
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100%|      | 30/30 [00:00<00:00, 109.04it/s]
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100%|      | 30/30 [00:00<00:00, 107.71it/s]
100%|      | 30/30 [00:00<00:00, 109.60it/s]
/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_logistic.py:818:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  extra_warning_msg=_LOGISTIC_SOLVER_CONVERGENCE_MSG,

Accuracy - spawner: 0.8411111111111111

100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
```

```
100%|      | 30/30 [00:10<00:00,  2.76it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
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100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.75it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
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100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:10<00:00,  2.90it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
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100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:08<00:00,  3.66it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
```

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100%|      | 30/30 [00:07<00:00,  3.88it/s]

Accuracy - wdba: 0.8288888888888889

100%|      | 30/30 [00:00<00:00, 91.15it/s]
100%|      | 30/30 [00:00<00:00, 88.76it/s]
100%|      | 30/30 [00:00<00:00, 101.93it/s]
100%|      | 30/30 [00:00<00:00, 99.21it/s]
100%|      | 30/30 [00:00<00:00, 102.27it/s]
100%|      | 30/30 [00:00<00:00, 109.31it/s]
100%|      | 30/30 [00:00<00:00, 105.47it/s]
100%|      | 30/30 [00:00<00:00, 106.99it/s]
100%|      | 30/30 [00:00<00:00, 100.12it/s]
100%|      | 30/30 [00:00<00:00, 106.21it/s]
100%|      | 30/30 [00:00<00:00, 105.42it/s]
100%|      | 30/30 [00:00<00:00, 91.13it/s]
100%|      | 30/30 [00:00<00:00, 99.40it/s]
100%|      | 30/30 [00:00<00:00, 105.89it/s]
100%|      | 30/30 [00:00<00:00, 100.84it/s]
100%|      | 30/30 [00:00<00:00, 98.94it/s]
100%|      | 30/30 [00:00<00:00, 95.78it/s]
100%|      | 30/30 [00:00<00:00, 95.98it/s]
100%|      | 30/30 [00:00<00:00, 97.69it/s]
100%|      | 30/30 [00:00<00:00, 99.68it/s]
100%|      | 30/30 [00:00<00:00, 106.63it/s]
100%|      | 30/30 [00:00<00:00, 94.12it/s]
100%|      | 30/30 [00:00<00:00, 97.39it/s]
100%|      | 30/30 [00:00<00:00, 95.51it/s]
100%|      | 30/30 [00:00<00:00, 88.02it/s]
100%|      | 30/30 [00:00<00:00, 102.29it/s]
100%|      | 30/30 [00:00<00:00, 99.19it/s]
100%|      | 30/30 [00:00<00:00, 105.66it/s]
100%|      | 30/30 [00:00<00:00, 102.82it/s]
100%|      | 30/30 [00:00<00:00, 99.92it/s]
100%|      | 30/30 [00:00<00:00, 100.44it/s]
100%|      | 30/30 [00:00<00:00, 107.54it/s]
100%|      | 30/30 [00:00<00:00, 99.06it/s]
100%|      | 30/30 [00:00<00:00, 108.92it/s]
100%|      | 30/30 [00:00<00:00, 100.84it/s]
100%|      | 30/30 [00:00<00:00, 104.87it/s]
100%|      | 30/30 [00:00<00:00, 86.38it/s]
100%|      | 30/30 [00:00<00:00, 96.18it/s]
100%|      | 30/30 [00:00<00:00, 100.73it/s]
100%|      | 30/30 [00:00<00:00, 98.85it/s]
100%|      | 30/30 [00:00<00:00, 100.03it/s]
100%|      | 30/30 [00:00<00:00, 92.59it/s]
100%|      | 30/30 [00:00<00:00, 91.56it/s]
100%|      | 30/30 [00:00<00:00, 101.30it/s]
100%|      | 30/30 [00:00<00:00, 95.91it/s]
```

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100%|      | 30/30 [00:00<00:00, 85.18it/s]
100%|      | 30/30 [00:00<00:00, 89.38it/s]
100%|      | 30/30 [00:00<00:00, 99.94it/s]
100%|      | 30/30 [00:00<00:00, 96.65it/s]
100%|      | 30/30 [00:00<00:00, 104.12it/s]
100%|      | 30/30 [00:00<00:00, 102.09it/s]
100%|      | 30/30 [00:00<00:00, 100.64it/s]
100%|      | 30/30 [00:00<00:00, 90.65it/s]
100%|      | 30/30 [00:00<00:00, 102.15it/s]
100%|      | 30/30 [00:00<00:00, 104.97it/s]
100%|      | 30/30 [00:00<00:00, 101.83it/s]
100%|      | 30/30 [00:00<00:00, 96.34it/s]
100%|      | 30/30 [00:00<00:00, 99.30it/s]
100%|      | 30/30 [00:00<00:00, 106.00it/s]
100%|      | 30/30 [00:00<00:00, 104.37it/s]
100%|      | 30/30 [00:00<00:00, 100.00it/s]
100%|      | 30/30 [00:00<00:00, 103.21it/s]
100%|      | 30/30 [00:00<00:00, 103.22it/s]
100%|      | 30/30 [00:00<00:00, 104.67it/s]
100%|      | 30/30 [00:00<00:00, 112.17it/s]
100%|      | 30/30 [00:00<00:00, 95.21it/s]
100%|      | 30/30 [00:00<00:00, 92.04it/s]
100%|      | 30/30 [00:00<00:00, 109.83it/s]
100%|      | 30/30 [00:00<00:00, 86.59it/s]
100%|      | 30/30 [00:00<00:00, 101.27it/s]
100%|      | 30/30 [00:00<00:00, 101.18it/s]
100%|      | 30/30 [00:00<00:00, 108.23it/s]
100%|      | 30/30 [00:00<00:00, 109.43it/s]
100%|      | 30/30 [00:00<00:00, 106.02it/s]
100%|      | 30/30 [00:00<00:00, 98.67it/s]
100%|      | 30/30 [00:00<00:00, 104.12it/s]
100%|      | 30/30 [00:00<00:00, 84.88it/s]
100%|      | 30/30 [00:00<00:00, 101.16it/s]
100%|      | 30/30 [00:00<00:00, 97.50it/s]
100%|      | 30/30 [00:00<00:00, 112.05it/s]
100%|      | 30/30 [00:00<00:00, 101.56it/s]
100%|      | 30/30 [00:00<00:00, 94.92it/s]
100%|      | 30/30 [00:00<00:00, 105.97it/s]
100%|      | 30/30 [00:00<00:00, 96.36it/s]
100%|      | 30/30 [00:00<00:00, 96.73it/s]
100%|      | 30/30 [00:00<00:00, 107.25it/s]
100%|      | 30/30 [00:00<00:00, 100.53it/s]
100%|      | 30/30 [00:00<00:00, 97.69it/s]
100%|      | 30/30 [00:00<00:00, 106.00it/s]
100%|      | 30/30 [00:00<00:00, 92.55it/s]
100%|      | 30/30 [00:00<00:00, 102.03it/s]
100%|      | 30/30 [00:00<00:00, 102.50it/s]
100%|      | 30/30 [00:00<00:00, 108.33it/s]
```

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100%|      | 30/30 [00:00<00:00, 97.76it/s]
100%|      | 30/30 [00:00<00:00, 101.22it/s]
100%|      | 30/30 [00:00<00:00, 102.56it/s]
100%|      | 30/30 [00:00<00:00, 98.88it/s]
100%|      | 30/30 [00:00<00:00, 97.44it/s]
100%|      | 30/30 [00:00<00:00, 101.64it/s]
/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_logistic.py:818:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  extra_warning_msg=_LOGISTIC_SOLVER_CONVERGENCE_MSG,

Accuracy - random_guided_warp: 0.8855555555555555

100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.51it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
100%|      | 30/30 [00:03<00:00,  8.53it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.60it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.14it/s]
100%|      | 30/30 [00:03<00:00,  8.49it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.14it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.07it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]

Accuracy - discriminative_guided_warp: 0.9077777777777778

/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_logistic.py:818:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  extra_warning_msg=_LOGISTIC_SOLVER_CONVERGENCE_MSG,
```

Linear Discriminant Analysis

[ ]:
```
lda = LinearDiscriminantAnalysis()
method_apply(lda, x_train, y_train, x_test, y_test)
```

```
Accuracy - None: 0.84
Accuracy - jitter: 0.8688888888888889
Accuracy - scaling: 0.7944444444444444
Accuracy - rotation: 0.35777777777777775

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
```

```
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray
```

```
Accuracy - permutation: 0.35888888888888887
Accuracy - magnitude_warp: 0.41444444444444445
Accuracy - time_warp: 0.78
Accuracy - window_slice: 0.9411111111111111
Accuracy - window_warp: 0.7833333333333333
```

```
100%|      | 30/30 [00:00<00:00, 87.95it/s]
100%|      | 30/30 [00:00<00:00, 112.52it/s]
100%|      | 30/30 [00:00<00:00, 93.64it/s]
100%|      | 30/30 [00:00<00:00, 103.68it/s]
100%|      | 30/30 [00:00<00:00, 104.73it/s]
100%|      | 30/30 [00:00<00:00, 108.28it/s]
100%|      | 30/30 [00:00<00:00, 98.63it/s]
100%|      | 30/30 [00:00<00:00, 104.97it/s]
100%|      | 30/30 [00:00<00:00, 102.86it/s]
100%|      | 30/30 [00:00<00:00, 103.95it/s]
100%|      | 30/30 [00:00<00:00, 108.02it/s]
100%|      | 30/30 [00:00<00:00, 108.50it/s]
100%|      | 30/30 [00:00<00:00, 105.11it/s]
100%|      | 30/30 [00:00<00:00, 101.42it/s]
100%|      | 30/30 [00:00<00:00, 106.73it/s]
100%|      | 30/30 [00:00<00:00, 106.68it/s]
100%|      | 30/30 [00:00<00:00, 95.74it/s]
100%|      | 30/30 [00:00<00:00, 100.69it/s]
100%|      | 30/30 [00:00<00:00, 99.25it/s]
100%|      | 30/30 [00:00<00:00, 101.67it/s]
100%|      | 30/30 [00:00<00:00, 106.70it/s]
100%|      | 30/30 [00:00<00:00, 102.40it/s]
100%|      | 30/30 [00:00<00:00, 113.20it/s]
100%|      | 30/30 [00:00<00:00, 97.48it/s]
100%|      | 30/30 [00:00<00:00, 96.75it/s]
100%|      | 30/30 [00:00<00:00, 100.46it/s]
100%|      | 30/30 [00:00<00:00, 102.13it/s]
100%|      | 30/30 [00:00<00:00, 101.93it/s]
100%|      | 30/30 [00:00<00:00, 97.54it/s]
100%|      | 30/30 [00:00<00:00, 103.06it/s]
100%|      | 30/30 [00:00<00:00, 111.07it/s]
100%|      | 30/30 [00:00<00:00, 111.74it/s]
100%|      | 30/30 [00:00<00:00, 104.30it/s]
100%|      | 30/30 [00:00<00:00, 98.04it/s]
100%|      | 30/30 [00:00<00:00, 101.59it/s]
100%|      | 30/30 [00:00<00:00, 99.73it/s]
100%|      | 30/30 [00:00<00:00, 101.60it/s]
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100%|      | 30/30 [00:00<00:00, 112.50it/s]
100%|      | 30/30 [00:00<00:00, 99.09it/s]
100%|      | 30/30 [00:00<00:00, 99.99it/s]
100%|      | 30/30 [00:00<00:00, 101.93it/s]
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100%|      | 30/30 [00:00<00:00, 95.72it/s]
100%|      | 30/30 [00:00<00:00, 100.53it/s]
100%|      | 30/30 [00:00<00:00, 97.95it/s]
100%|      | 30/30 [00:00<00:00, 101.07it/s]
100%|      | 30/30 [00:00<00:00, 98.07it/s]
100%|      | 30/30 [00:00<00:00, 109.97it/s]
100%|      | 30/30 [00:00<00:00, 100.12it/s]
100%|      | 30/30 [00:00<00:00, 108.24it/s]
100%|      | 30/30 [00:00<00:00, 99.91it/s]
100%|      | 30/30 [00:00<00:00, 105.65it/s]
100%|      | 30/30 [00:00<00:00, 103.16it/s]
100%|      | 30/30 [00:00<00:00, 108.77it/s]
100%|      | 30/30 [00:00<00:00, 105.17it/s]
100%|      | 30/30 [00:00<00:00, 103.36it/s]
100%|      | 30/30 [00:00<00:00, 104.80it/s]
100%|      | 30/30 [00:00<00:00, 95.04it/s]
100%|      | 30/30 [00:00<00:00, 111.09it/s]
100%|      | 30/30 [00:00<00:00, 104.21it/s]
100%|      | 30/30 [00:00<00:00, 96.46it/s]
100%|      | 30/30 [00:00<00:00, 92.15it/s]
100%|      | 30/30 [00:00<00:00, 99.09it/s]
100%|      | 30/30 [00:00<00:00, 104.63it/s]
100%|      | 30/30 [00:00<00:00, 104.96it/s]
100%|      | 30/30 [00:00<00:00, 99.48it/s]
100%|      | 30/30 [00:00<00:00, 103.84it/s]
100%|      | 30/30 [00:00<00:00, 108.25it/s]
100%|      | 30/30 [00:00<00:00, 111.22it/s]
100%|      | 30/30 [00:00<00:00, 105.99it/s]
100%|      | 30/30 [00:00<00:00, 107.15it/s]
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100%|      | 30/30 [00:00<00:00, 108.41it/s]
100%|      | 30/30 [00:00<00:00, 107.76it/s]
100%|      | 30/30 [00:00<00:00, 106.73it/s]
100%|      | 30/30 [00:00<00:00, 104.39it/s]
100%|      | 30/30 [00:00<00:00, 104.65it/s]
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100%|      | 30/30 [00:00<00:00, 103.92it/s]
100%|      | 30/30 [00:00<00:00, 108.11it/s]
100%|      | 30/30 [00:00<00:00, 96.40it/s]
100%|      | 30/30 [00:00<00:00, 106.95it/s]
100%|      | 30/30 [00:00<00:00, 113.26it/s]
100%|      | 30/30 [00:00<00:00, 107.06it/s]
100%|      | 30/30 [00:00<00:00, 102.20it/s]
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100%|      | 30/30 [00:00<00:00, 106.71it/s]
100%|      | 30/30 [00:00<00:00, 106.67it/s]
100%|      | 30/30 [00:00<00:00, 93.88it/s]
100%|      | 30/30 [00:00<00:00, 100.05it/s]
100%|      | 30/30 [00:00<00:00, 104.82it/s]
100%|      | 30/30 [00:00<00:00, 105.38it/s]
100%|      | 30/30 [00:00<00:00, 103.94it/s]
100%|      | 30/30 [00:00<00:00, 109.66it/s]
100%|      | 30/30 [00:00<00:00, 101.27it/s]
100%|      | 30/30 [00:00<00:00, 91.26it/s]
100%|      | 30/30 [00:00<00:00, 100.62it/s]
100%|      | 30/30 [00:00<00:00, 103.23it/s]
100%|      | 30/30 [00:00<00:00, 99.55it/s]
100%|      | 30/30 [00:00<00:00, 110.87it/s]
```

```
Accuracy - spawner: 0.8377777777777777
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100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
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100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
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100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
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100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
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100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
```

```
Accuracy - wdba: 0.8388888888888889
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100%|      | 30/30 [00:00<00:00, 86.86it/s]
100%|      | 30/30 [00:00<00:00, 98.97it/s]
100%|      | 30/30 [00:00<00:00, 95.05it/s]
100%|      | 30/30 [00:00<00:00, 82.96it/s]
100%|      | 30/30 [00:00<00:00, 94.72it/s]
100%|      | 30/30 [00:00<00:00, 107.10it/s]
100%|      | 30/30 [00:00<00:00, 101.08it/s]
100%|      | 30/30 [00:00<00:00, 96.81it/s]
100%|      | 30/30 [00:00<00:00, 107.61it/s]
100%|      | 30/30 [00:00<00:00, 93.50it/s]
100%|      | 30/30 [00:00<00:00, 98.26it/s]
100%|      | 30/30 [00:00<00:00, 104.45it/s]
100%|      | 30/30 [00:00<00:00, 104.30it/s]
100%|      | 30/30 [00:00<00:00, 91.31it/s]
100%|      | 30/30 [00:00<00:00, 94.12it/s]
100%|      | 30/30 [00:00<00:00, 90.06it/s]
100%|      | 30/30 [00:00<00:00, 101.81it/s]
100%|      | 30/30 [00:00<00:00, 102.24it/s]
100%|      | 30/30 [00:00<00:00, 96.57it/s]
100%|      | 30/30 [00:00<00:00, 100.68it/s]
100%|      | 30/30 [00:00<00:00, 101.21it/s]
100%|      | 30/30 [00:00<00:00, 106.93it/s]
100%|      | 30/30 [00:00<00:00, 99.39it/s]
100%|      | 30/30 [00:00<00:00, 103.15it/s]
100%|      | 30/30 [00:00<00:00, 107.01it/s]
100%|      | 30/30 [00:00<00:00, 107.99it/s]
100%|      | 30/30 [00:00<00:00, 103.77it/s]
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100%|      | 30/30 [00:00<00:00, 99.08it/s]
100%|      | 30/30 [00:00<00:00, 89.66it/s]
100%|      | 30/30 [00:00<00:00, 93.31it/s]
100%|      | 30/30 [00:00<00:00, 101.52it/s]
100%|      | 30/30 [00:00<00:00, 93.49it/s]
100%|      | 30/30 [00:00<00:00, 102.05it/s]
100%|      | 30/30 [00:00<00:00, 102.52it/s]
100%|      | 30/30 [00:00<00:00, 108.83it/s]
100%|      | 30/30 [00:00<00:00, 91.79it/s]
100%|      | 30/30 [00:00<00:00, 101.88it/s]
100%|      | 30/30 [00:00<00:00, 97.48it/s]
100%|      | 30/30 [00:00<00:00, 92.37it/s]
100%|      | 30/30 [00:00<00:00, 102.13it/s]
100%|      | 30/30 [00:00<00:00, 108.41it/s]
100%|      | 30/30 [00:00<00:00, 93.42it/s]
100%|      | 30/30 [00:00<00:00, 106.00it/s]
100%|      | 30/30 [00:00<00:00, 90.44it/s]
100%|      | 30/30 [00:00<00:00, 91.84it/s]
100%|      | 30/30 [00:00<00:00, 100.69it/s]
100%|      | 30/30 [00:00<00:00, 102.86it/s]
100%|      | 30/30 [00:00<00:00, 108.27it/s]
100%|      | 30/30 [00:00<00:00, 105.62it/s]
100%|      | 30/30 [00:00<00:00, 98.68it/s]
100%|      | 30/30 [00:00<00:00, 96.37it/s]
100%|      | 30/30 [00:00<00:00, 88.38it/s]
100%|      | 30/30 [00:00<00:00, 102.74it/s]
100%|      | 30/30 [00:00<00:00, 98.02it/s]
100%|      | 30/30 [00:00<00:00, 97.05it/s]
100%|      | 30/30 [00:00<00:00, 99.51it/s]
100%|      | 30/30 [00:00<00:00, 99.84it/s]
100%|      | 30/30 [00:00<00:00, 93.06it/s]
100%|      | 30/30 [00:00<00:00, 94.42it/s]
100%|      | 30/30 [00:00<00:00, 99.67it/s]
100%|      | 30/30 [00:00<00:00, 106.69it/s]
100%|      | 30/30 [00:00<00:00, 97.19it/s]
100%|      | 30/30 [00:00<00:00, 83.46it/s]
100%|      | 30/30 [00:00<00:00, 101.56it/s]
100%|      | 30/30 [00:00<00:00, 104.39it/s]
100%|      | 30/30 [00:00<00:00, 105.46it/s]
100%|      | 30/30 [00:00<00:00, 102.23it/s]
100%|      | 30/30 [00:00<00:00, 84.62it/s]
100%|      | 30/30 [00:00<00:00, 100.97it/s]
100%|      | 30/30 [00:00<00:00, 106.51it/s]
100%|      | 30/30 [00:00<00:00, 97.62it/s]
100%|      | 30/30 [00:00<00:00, 102.65it/s]
100%|      | 30/30 [00:00<00:00, 92.34it/s]
100%|      | 30/30 [00:00<00:00, 89.88it/s]
100%|      | 30/30 [00:00<00:00, 105.86it/s]
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100%|      | 30/30 [00:00<00:00, 94.72it/s]
100%|      | 30/30 [00:00<00:00, 87.77it/s]
100%|      | 30/30 [00:00<00:00, 97.61it/s]
100%|      | 30/30 [00:00<00:00, 100.23it/s]
100%|      | 30/30 [00:00<00:00, 101.77it/s]
100%|      | 30/30 [00:00<00:00, 97.31it/s]
100%|      | 30/30 [00:00<00:00, 98.77it/s]
100%|      | 30/30 [00:00<00:00, 101.21it/s]
100%|      | 30/30 [00:00<00:00, 101.36it/s]
100%|      | 30/30 [00:00<00:00, 99.16it/s]
100%|      | 30/30 [00:00<00:00, 92.28it/s]
100%|      | 30/30 [00:00<00:00, 96.47it/s]
100%|      | 30/30 [00:00<00:00, 92.89it/s]
100%|      | 30/30 [00:00<00:00, 98.80it/s]
100%|      | 30/30 [00:00<00:00, 104.45it/s]
100%|      | 30/30 [00:00<00:00, 101.51it/s]
100%|      | 30/30 [00:00<00:00, 105.04it/s]
100%|      | 30/30 [00:00<00:00, 91.76it/s]
100%|      | 30/30 [00:00<00:00, 92.30it/s]
100%|      | 30/30 [00:00<00:00, 109.82it/s]
100%|      | 30/30 [00:00<00:00, 99.32it/s]
100%|      | 30/30 [00:00<00:00, 100.46it/s]
100%|      | 30/30 [00:00<00:00, 104.57it/s]
100%|      | 30/30 [00:00<00:00, 103.90it/s]

Accuracy - random_guided_warp: 0.7811111111111111

100%|      | 30/30 [00:03<00:00,  8.03it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.16it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.10it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  6.74it/s]
100%|      | 30/30 [00:03<00:00,  8.16it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.03it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.14it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.48it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.54it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.61it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  7.97it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]

Accuracy - discriminative_guided_warp: 0.8866666666666667
```

Gaussian Naive Bayes

[ ]:
```
gnb = GaussianNB()
method_apply(gnb, x_train, y_train, x_test, y_test)
```

```
Accuracy - None: 0.8944444444444445
Accuracy - jitter: 0.8966666666666666
Accuracy - scaling: 0.8988888888888888
Accuracy - rotation: 0.5777777777777777
Accuracy - permutation: 0.8611111111111112

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
```

```
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray
```

```
Accuracy - magnitude_warp: 0.9077777777777778
Accuracy - time_warp: 0.8244444444444444
Accuracy - window_slice: 0.9088888888888889
Accuracy - window_warp: 0.8766666666666667
```

```
100%|      | 30/30 [00:00<00:00, 109.11it/s]
100%|      | 30/30 [00:00<00:00, 99.80it/s]
100%|      | 30/30 [00:00<00:00, 101.40it/s]
100%|      | 30/30 [00:00<00:00, 98.51it/s]
100%|      | 30/30 [00:00<00:00, 105.09it/s]
100%|      | 30/30 [00:00<00:00, 99.83it/s]
100%|      | 30/30 [00:00<00:00, 105.16it/s]
100%|      | 30/30 [00:00<00:00, 96.86it/s]
100%|      | 30/30 [00:00<00:00, 95.80it/s]
100%|      | 30/30 [00:00<00:00, 95.39it/s]
100%|      | 30/30 [00:00<00:00, 103.22it/s]
100%|      | 30/30 [00:00<00:00, 112.40it/s]
100%|      | 30/30 [00:00<00:00, 109.34it/s]
100%|      | 30/30 [00:00<00:00, 109.03it/s]
100%|      | 30/30 [00:00<00:00, 113.21it/s]
100%|      | 30/30 [00:00<00:00, 93.66it/s]
100%|      | 30/30 [00:00<00:00, 103.56it/s]
100%|      | 30/30 [00:00<00:00, 106.25it/s]
100%|      | 30/30 [00:00<00:00, 101.11it/s]
100%|      | 30/30 [00:00<00:00, 92.87it/s]
100%|      | 30/30 [00:00<00:00, 103.56it/s]
100%|      | 30/30 [00:00<00:00, 91.39it/s]
100%|      | 30/30 [00:00<00:00, 97.77it/s]
100%|      | 30/30 [00:00<00:00, 107.05it/s]
100%|      | 30/30 [00:00<00:00, 109.28it/s]
100%|      | 30/30 [00:00<00:00, 101.42it/s]
100%|      | 30/30 [00:00<00:00, 103.25it/s]
100%|      | 30/30 [00:00<00:00, 105.73it/s]
100%|      | 30/30 [00:00<00:00, 99.75it/s]
100%|      | 30/30 [00:00<00:00, 100.09it/s]
100%|      | 30/30 [00:00<00:00, 105.19it/s]
100%|      | 30/30 [00:00<00:00, 99.85it/s]
100%|      | 30/30 [00:00<00:00, 97.97it/s]
100%|      | 30/30 [00:00<00:00, 98.29it/s]
100%|      | 30/30 [00:00<00:00, 110.54it/s]
100%|      | 30/30 [00:00<00:00, 104.06it/s]
100%|      | 30/30 [00:00<00:00, 100.62it/s]
100%|      | 30/30 [00:00<00:00, 98.82it/s]
100%|      | 30/30 [00:00<00:00, 98.14it/s]
```

```
100%|      | 30/30 [00:00<00:00, 92.55it/s]
100%|      | 30/30 [00:00<00:00, 107.85it/s]
100%|      | 30/30 [00:00<00:00, 106.36it/s]
100%|      | 30/30 [00:00<00:00, 100.58it/s]
100%|      | 30/30 [00:00<00:00, 107.47it/s]
100%|      | 30/30 [00:00<00:00, 101.14it/s]
100%|      | 30/30 [00:00<00:00, 108.32it/s]
100%|      | 30/30 [00:00<00:00, 102.20it/s]
100%|      | 30/30 [00:00<00:00, 96.38it/s]
100%|      | 30/30 [00:00<00:00, 94.13it/s]
100%|      | 30/30 [00:00<00:00, 94.44it/s]
100%|      | 30/30 [00:00<00:00, 99.26it/s]
100%|      | 30/30 [00:00<00:00, 95.77it/s]
100%|      | 30/30 [00:00<00:00, 107.56it/s]
100%|      | 30/30 [00:00<00:00, 99.74it/s]
100%|      | 30/30 [00:00<00:00, 95.86it/s]
100%|      | 30/30 [00:00<00:00, 100.56it/s]
100%|      | 30/30 [00:00<00:00, 98.49it/s]
100%|      | 30/30 [00:00<00:00, 106.25it/s]
100%|      | 30/30 [00:00<00:00, 104.10it/s]
100%|      | 30/30 [00:00<00:00, 94.62it/s]
100%|      | 30/30 [00:00<00:00, 92.01it/s]
100%|      | 30/30 [00:00<00:00, 104.30it/s]
100%|      | 30/30 [00:00<00:00, 112.88it/s]
100%|      | 30/30 [00:00<00:00, 93.50it/s]
100%|      | 30/30 [00:00<00:00, 104.89it/s]
100%|      | 30/30 [00:00<00:00, 107.81it/s]
100%|      | 30/30 [00:00<00:00, 102.94it/s]
100%|      | 30/30 [00:00<00:00, 101.11it/s]
100%|      | 30/30 [00:00<00:00, 106.63it/s]
100%|      | 30/30 [00:00<00:00, 92.70it/s]
100%|      | 30/30 [00:00<00:00, 100.00it/s]
100%|      | 30/30 [00:00<00:00, 105.23it/s]
100%|      | 30/30 [00:00<00:00, 109.95it/s]
100%|      | 30/30 [00:00<00:00, 101.76it/s]
100%|      | 30/30 [00:00<00:00, 106.34it/s]
100%|      | 30/30 [00:00<00:00, 108.80it/s]
100%|      | 30/30 [00:00<00:00, 93.89it/s]
100%|      | 30/30 [00:00<00:00, 103.23it/s]
100%|      | 30/30 [00:00<00:00, 98.40it/s]
100%|      | 30/30 [00:00<00:00, 105.20it/s]
100%|      | 30/30 [00:00<00:00, 104.46it/s]
100%|      | 30/30 [00:00<00:00, 104.12it/s]
100%|      | 30/30 [00:00<00:00, 103.78it/s]
100%|      | 30/30 [00:00<00:00, 102.82it/s]
100%|      | 30/30 [00:00<00:00, 107.18it/s]
100%|      | 30/30 [00:00<00:00, 111.55it/s]
100%|      | 30/30 [00:00<00:00, 103.04it/s]
```

```
100%|      | 30/30 [00:00<00:00, 106.55it/s]
100%|      | 30/30 [00:00<00:00, 100.61it/s]
100%|      | 30/30 [00:00<00:00, 99.67it/s]
100%|      | 30/30 [00:00<00:00, 105.30it/s]
100%|      | 30/30 [00:00<00:00, 108.30it/s]
100%|      | 30/30 [00:00<00:00, 110.97it/s]
100%|      | 30/30 [00:00<00:00, 104.07it/s]
100%|      | 30/30 [00:00<00:00, 102.18it/s]
100%|      | 30/30 [00:00<00:00, 111.65it/s]
100%|      | 30/30 [00:00<00:00, 109.22it/s]
100%|      | 30/30 [00:00<00:00, 107.87it/s]
100%|      | 30/30 [00:00<00:00, 107.17it/s]
```

```
Accuracy - spawner: 0.8988888888888888
```

```
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.99it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  4.00it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:09<00:00,  3.32it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  4.00it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
```

```
Accuracy - wdba: 0.7844444444444445
```

```
100%|      | 30/30 [00:00<00:00, 99.09it/s]
100%|      | 30/30 [00:00<00:00, 100.48it/s]
100%|      | 30/30 [00:00<00:00, 98.85it/s]
100%|      | 30/30 [00:00<00:00, 106.30it/s]
100%|      | 30/30 [00:00<00:00, 109.56it/s]
100%|      | 30/30 [00:00<00:00, 109.33it/s]
100%|      | 30/30 [00:00<00:00, 100.71it/s]
100%|      | 30/30 [00:00<00:00, 101.47it/s]
100%|      | 30/30 [00:00<00:00, 96.36it/s]
100%|      | 30/30 [00:00<00:00, 90.23it/s]
100%|      | 30/30 [00:00<00:00, 96.55it/s]
100%|      | 30/30 [00:00<00:00, 108.33it/s]
100%|      | 30/30 [00:00<00:00, 106.25it/s]
100%|      | 30/30 [00:00<00:00, 107.44it/s]
100%|      | 30/30 [00:00<00:00, 97.04it/s]
100%|      | 30/30 [00:00<00:00, 100.20it/s]
100%|      | 30/30 [00:00<00:00, 99.93it/s]
100%|      | 30/30 [00:00<00:00, 104.00it/s]
100%|      | 30/30 [00:00<00:00, 95.04it/s]
100%|      | 30/30 [00:00<00:00, 93.58it/s]
100%|      | 30/30 [00:00<00:00, 91.07it/s]
100%|      | 30/30 [00:00<00:00, 95.34it/s]
100%|      | 30/30 [00:00<00:00, 97.96it/s]
100%|      | 30/30 [00:00<00:00, 101.08it/s]
100%|      | 30/30 [00:00<00:00, 101.97it/s]
100%|      | 30/30 [00:00<00:00, 98.53it/s]
100%|      | 30/30 [00:00<00:00, 100.00it/s]
100%|      | 30/30 [00:00<00:00, 103.07it/s]
100%|      | 30/30 [00:00<00:00, 101.33it/s]
```

```
100%|      | 30/30 [00:00<00:00, 102.02it/s]
100%|      | 30/30 [00:00<00:00, 99.21it/s]
100%|      | 30/30 [00:00<00:00, 94.79it/s]
100%|      | 30/30 [00:00<00:00, 92.33it/s]
100%|      | 30/30 [00:00<00:00, 101.83it/s]
100%|      | 30/30 [00:00<00:00, 94.94it/s]
100%|      | 30/30 [00:00<00:00, 99.30it/s]
100%|      | 30/30 [00:00<00:00, 105.71it/s]
100%|      | 30/30 [00:00<00:00, 108.38it/s]
100%|      | 30/30 [00:00<00:00, 104.64it/s]
100%|      | 30/30 [00:00<00:00, 105.28it/s]
100%|      | 30/30 [00:00<00:00, 107.49it/s]
100%|      | 30/30 [00:00<00:00, 98.42it/s]
100%|      | 30/30 [00:00<00:00, 104.34it/s]
100%|      | 30/30 [00:00<00:00, 105.22it/s]
100%|      | 30/30 [00:00<00:00, 108.26it/s]
100%|      | 30/30 [00:00<00:00, 100.42it/s]
100%|      | 30/30 [00:00<00:00, 105.61it/s]
100%|      | 30/30 [00:00<00:00, 100.24it/s]
100%|      | 30/30 [00:00<00:00, 88.46it/s]
100%|      | 30/30 [00:00<00:00, 101.90it/s]
100%|      | 30/30 [00:00<00:00, 95.37it/s]
100%|      | 30/30 [00:00<00:00, 105.46it/s]
100%|      | 30/30 [00:00<00:00, 103.40it/s]
100%|      | 30/30 [00:00<00:00, 109.58it/s]
100%|      | 30/30 [00:00<00:00, 109.73it/s]
100%|      | 30/30 [00:00<00:00, 107.77it/s]
100%|      | 30/30 [00:00<00:00, 105.31it/s]
100%|      | 30/30 [00:00<00:00, 108.26it/s]
100%|      | 30/30 [00:00<00:00, 109.40it/s]
100%|      | 30/30 [00:00<00:00, 99.70it/s]
100%|      | 30/30 [00:00<00:00, 94.89it/s]
100%|      | 30/30 [00:00<00:00, 102.45it/s]
100%|      | 30/30 [00:00<00:00, 101.57it/s]
100%|      | 30/30 [00:00<00:00, 105.11it/s]
100%|      | 30/30 [00:00<00:00, 100.42it/s]
100%|      | 30/30 [00:00<00:00, 108.30it/s]
100%|      | 30/30 [00:00<00:00, 107.16it/s]
100%|      | 30/30 [00:00<00:00, 104.38it/s]
100%|      | 30/30 [00:00<00:00, 98.58it/s]
100%|      | 30/30 [00:00<00:00, 96.30it/s]
100%|      | 30/30 [00:00<00:00, 97.63it/s]
100%|      | 30/30 [00:00<00:00, 106.08it/s]
100%|      | 30/30 [00:00<00:00, 106.27it/s]
100%|      | 30/30 [00:00<00:00, 97.91it/s]
100%|      | 30/30 [00:00<00:00, 99.94it/s]
100%|      | 30/30 [00:00<00:00, 99.56it/s]
100%|      | 30/30 [00:00<00:00, 100.13it/s]
```

```
100%|      | 30/30 [00:00<00:00, 103.22it/s]
100%|      | 30/30 [00:00<00:00, 95.95it/s]
100%|      | 30/30 [00:00<00:00, 94.71it/s]
100%|      | 30/30 [00:00<00:00, 109.18it/s]
100%|      | 30/30 [00:00<00:00, 87.77it/s]
100%|      | 30/30 [00:00<00:00, 97.73it/s]
100%|      | 30/30 [00:00<00:00, 103.47it/s]
100%|      | 30/30 [00:00<00:00, 97.71it/s]
100%|      | 30/30 [00:00<00:00, 107.91it/s]
100%|      | 30/30 [00:00<00:00, 103.64it/s]
100%|      | 30/30 [00:00<00:00, 108.43it/s]
100%|      | 30/30 [00:00<00:00, 99.48it/s]
100%|      | 30/30 [00:00<00:00, 90.30it/s]
100%|      | 30/30 [00:00<00:00, 105.91it/s]
100%|      | 30/30 [00:00<00:00, 96.26it/s]
100%|      | 30/30 [00:00<00:00, 106.62it/s]
100%|      | 30/30 [00:00<00:00, 105.99it/s]
100%|      | 30/30 [00:00<00:00, 92.97it/s]
100%|      | 30/30 [00:00<00:00, 104.31it/s]
100%|      | 30/30 [00:00<00:00, 103.49it/s]
100%|      | 30/30 [00:00<00:00, 104.13it/s]
100%|      | 30/30 [00:00<00:00, 101.12it/s]

Accuracy - random_guided_warp: 0.9044444444444445

100%|      | 30/30 [00:03<00:00,  8.49it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.54it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.50it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.51it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.48it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.52it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.47it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.16it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.50it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.48it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]

Accuracy - discriminative_guided_warp: 0.9033333333333333
```

Decision Tree Classifier

[ ]:
```
dtc= DecisionTreeClassifier(random_state=1234)
method_apply(dtc, x_train, y_train, x_test, y_test)
```

```
Accuracy - None: 0.7566666666666667
Accuracy - jitter: 0.8011111111111111
Accuracy - scaling: 0.7166666666666667
Accuracy - rotation: 0.4722222222222222

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
```

```
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Accuracy - permutation: 0.5411111111111111
Accuracy - magnitude_warp: 0.7311111111111112
Accuracy - time_warp: 0.7322222222222222
Accuracy - window_slice: 0.8255555555555556
Accuracy - window_warp: 0.8311111111111111

100%|      | 30/30 [00:00<00:00, 96.98it/s]
100%|      | 30/30 [00:00<00:00, 87.44it/s]
100%|      | 30/30 [00:00<00:00, 102.34it/s]
100%|      | 30/30 [00:00<00:00, 100.12it/s]
100%|      | 30/30 [00:00<00:00, 95.61it/s]
100%|      | 30/30 [00:00<00:00, 95.51it/s]
100%|      | 30/30 [00:00<00:00, 92.23it/s]
100%|      | 30/30 [00:00<00:00, 94.88it/s]
100%|      | 30/30 [00:00<00:00, 100.77it/s]
100%|      | 30/30 [00:00<00:00, 101.93it/s]
100%|      | 30/30 [00:00<00:00, 95.01it/s]
100%|      | 30/30 [00:00<00:00, 102.31it/s]
100%|      | 30/30 [00:00<00:00, 101.61it/s]
100%|      | 30/30 [00:00<00:00, 91.09it/s]
100%|      | 30/30 [00:00<00:00, 93.47it/s]
100%|      | 30/30 [00:00<00:00, 102.74it/s]
100%|      | 30/30 [00:00<00:00, 106.48it/s]
100%|      | 30/30 [00:00<00:00, 88.78it/s]
100%|      | 30/30 [00:00<00:00, 107.79it/s]
100%|      | 30/30 [00:00<00:00, 99.80it/s]
100%|      | 30/30 [00:00<00:00, 98.42it/s]
100%|      | 30/30 [00:00<00:00, 101.89it/s]
100%|      | 30/30 [00:00<00:00, 97.02it/s]
100%|      | 30/30 [00:00<00:00, 100.70it/s]
100%|      | 30/30 [00:00<00:00, 107.06it/s]
100%|      | 30/30 [00:00<00:00, 102.73it/s]
100%|      | 30/30 [00:00<00:00, 92.92it/s]
100%|      | 30/30 [00:00<00:00, 105.65it/s]
100%|      | 30/30 [00:00<00:00, 100.45it/s]
100%|      | 30/30 [00:00<00:00, 102.38it/s]
100%|      | 30/30 [00:00<00:00, 104.27it/s]
100%|      | 30/30 [00:00<00:00, 109.44it/s]
100%|      | 30/30 [00:00<00:00, 103.96it/s]
100%|      | 30/30 [00:00<00:00, 106.64it/s]
100%|      | 30/30 [00:00<00:00, 98.60it/s]
100%|      | 30/30 [00:00<00:00, 103.87it/s]
100%|      | 30/30 [00:00<00:00, 97.83it/s]
100%|      | 30/30 [00:00<00:00, 102.27it/s]
100%|      | 30/30 [00:00<00:00, 105.84it/s]
100%|      | 30/30 [00:00<00:00, 106.22it/s]
```

```
100%|      | 30/30 [00:00<00:00, 98.31it/s]
100%|      | 30/30 [00:00<00:00, 99.92it/s]
100%|      | 30/30 [00:00<00:00, 105.86it/s]
100%|      | 30/30 [00:00<00:00, 97.49it/s]
100%|      | 30/30 [00:00<00:00, 106.68it/s]
100%|      | 30/30 [00:00<00:00, 106.84it/s]
100%|      | 30/30 [00:00<00:00, 110.51it/s]
100%|      | 30/30 [00:00<00:00, 96.88it/s]
100%|      | 30/30 [00:00<00:00, 101.88it/s]
100%|      | 30/30 [00:00<00:00, 106.71it/s]
100%|      | 30/30 [00:00<00:00, 105.88it/s]
100%|      | 30/30 [00:00<00:00, 103.46it/s]
100%|      | 30/30 [00:00<00:00, 106.94it/s]
100%|      | 30/30 [00:00<00:00, 104.71it/s]
100%|      | 30/30 [00:00<00:00, 91.71it/s]
100%|      | 30/30 [00:00<00:00, 96.27it/s]
100%|      | 30/30 [00:00<00:00, 96.55it/s]
100%|      | 30/30 [00:00<00:00, 94.66it/s]
100%|      | 30/30 [00:00<00:00, 104.37it/s]
100%|      | 30/30 [00:00<00:00, 100.11it/s]
100%|      | 30/30 [00:00<00:00, 97.25it/s]
100%|      | 30/30 [00:00<00:00, 103.56it/s]
100%|      | 30/30 [00:00<00:00, 96.39it/s]
100%|      | 30/30 [00:00<00:00, 108.47it/s]
100%|      | 30/30 [00:00<00:00, 106.18it/s]
100%|      | 30/30 [00:00<00:00, 100.07it/s]
100%|      | 30/30 [00:00<00:00, 99.24it/s]
100%|      | 30/30 [00:00<00:00, 96.26it/s]
100%|      | 30/30 [00:00<00:00, 104.81it/s]
100%|      | 30/30 [00:00<00:00, 105.87it/s]
100%|      | 30/30 [00:00<00:00, 100.96it/s]
100%|      | 30/30 [00:00<00:00, 94.38it/s]
100%|      | 30/30 [00:00<00:00, 100.34it/s]
100%|      | 30/30 [00:00<00:00, 99.85it/s]
100%|      | 30/30 [00:00<00:00, 101.97it/s]
100%|      | 30/30 [00:00<00:00, 106.19it/s]
100%|      | 30/30 [00:00<00:00, 101.32it/s]
100%|      | 30/30 [00:00<00:00, 94.44it/s]
100%|      | 30/30 [00:00<00:00, 108.21it/s]
100%|      | 30/30 [00:00<00:00, 99.01it/s]
100%|      | 30/30 [00:00<00:00, 96.54it/s]
100%|      | 30/30 [00:00<00:00, 108.94it/s]
100%|      | 30/30 [00:00<00:00, 104.16it/s]
100%|      | 30/30 [00:00<00:00, 99.40it/s]
100%|      | 30/30 [00:00<00:00, 98.25it/s]
100%|      | 30/30 [00:00<00:00, 104.89it/s]
100%|      | 30/30 [00:00<00:00, 98.14it/s]
100%|      | 30/30 [00:00<00:00, 101.56it/s]
```

```
100%|      | 30/30 [00:00<00:00, 108.73it/s]
100%|      | 30/30 [00:00<00:00, 109.91it/s]
100%|      | 30/30 [00:00<00:00, 107.12it/s]
100%|      | 30/30 [00:00<00:00, 109.01it/s]
100%|      | 30/30 [00:00<00:00, 102.85it/s]
100%|      | 30/30 [00:00<00:00, 104.17it/s]
100%|      | 30/30 [00:00<00:00, 102.04it/s]
100%|      | 30/30 [00:00<00:00, 106.15it/s]
100%|      | 30/30 [00:00<00:00, 106.30it/s]
100%|      | 30/30 [00:00<00:00, 94.73it/s]
100%|      | 30/30 [00:00<00:00, 88.89it/s]

Accuracy - spawner: 0.7755555555555556

100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  4.00it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.99it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  4.02it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  4.00it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.99it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.99it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.99it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.99it/s]
100%|      | 30/30 [00:07<00:00,  3.99it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  4.01it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  4.00it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  4.00it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  4.00it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  4.00it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.99it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.99it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.99it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
```

```
Accuracy - wdba: 0.7244444444444444
```

```
100%|      | 30/30 [00:00<00:00, 88.00it/s]
100%|      | 30/30 [00:00<00:00, 92.18it/s]
100%|      | 30/30 [00:00<00:00, 99.14it/s]
100%|      | 30/30 [00:00<00:00, 84.69it/s]
100%|      | 30/30 [00:00<00:00, 95.16it/s]
100%|      | 30/30 [00:00<00:00, 108.53it/s]
100%|      | 30/30 [00:00<00:00, 106.80it/s]
100%|      | 30/30 [00:00<00:00, 103.42it/s]
100%|      | 30/30 [00:00<00:00, 83.67it/s]
100%|      | 30/30 [00:00<00:00, 93.97it/s]
100%|      | 30/30 [00:00<00:00, 100.47it/s]
100%|      | 30/30 [00:00<00:00, 92.38it/s]
100%|      | 30/30 [00:00<00:00, 104.95it/s]
100%|      | 30/30 [00:00<00:00, 105.58it/s]
100%|      | 30/30 [00:00<00:00, 100.32it/s]
100%|      | 30/30 [00:00<00:00, 104.72it/s]
100%|      | 30/30 [00:00<00:00, 107.38it/s]
100%|      | 30/30 [00:00<00:00, 98.11it/s]
100%|      | 30/30 [00:00<00:00, 99.71it/s]
100%|      | 30/30 [00:00<00:00, 100.39it/s]
100%|      | 30/30 [00:00<00:00, 106.01it/s]
100%|      | 30/30 [00:00<00:00, 105.98it/s]
100%|      | 30/30 [00:00<00:00, 107.07it/s]
100%|      | 30/30 [00:00<00:00, 109.53it/s]
100%|      | 30/30 [00:00<00:00, 100.81it/s]
100%|      | 30/30 [00:00<00:00, 100.89it/s]
100%|      | 30/30 [00:00<00:00, 106.08it/s]
100%|      | 30/30 [00:00<00:00, 104.17it/s]
100%|      | 30/30 [00:00<00:00, 102.57it/s]
100%|      | 30/30 [00:00<00:00, 104.14it/s]
```

```
100%|      | 30/30 [00:00<00:00, 104.14it/s]
100%|      | 30/30 [00:00<00:00, 99.15it/s]
100%|      | 30/30 [00:00<00:00, 90.39it/s]
100%|      | 30/30 [00:00<00:00, 96.33it/s]
100%|      | 30/30 [00:00<00:00, 102.55it/s]
100%|      | 30/30 [00:00<00:00, 102.68it/s]
100%|      | 30/30 [00:00<00:00, 96.13it/s]
100%|      | 30/30 [00:00<00:00, 98.58it/s]
100%|      | 30/30 [00:00<00:00, 100.00it/s]
100%|      | 30/30 [00:00<00:00, 100.13it/s]
100%|      | 30/30 [00:00<00:00, 106.28it/s]
100%|      | 30/30 [00:00<00:00, 101.43it/s]
100%|      | 30/30 [00:00<00:00, 105.54it/s]
100%|      | 30/30 [00:00<00:00, 99.99it/s]
100%|      | 30/30 [00:00<00:00, 105.18it/s]
100%|      | 30/30 [00:00<00:00, 99.02it/s]
100%|      | 30/30 [00:00<00:00, 103.14it/s]
100%|      | 30/30 [00:00<00:00, 104.90it/s]
100%|      | 30/30 [00:00<00:00, 98.43it/s]
100%|      | 30/30 [00:00<00:00, 106.90it/s]
100%|      | 30/30 [00:00<00:00, 105.78it/s]
100%|      | 30/30 [00:00<00:00, 98.81it/s]
100%|      | 30/30 [00:00<00:00, 101.01it/s]
100%|      | 30/30 [00:00<00:00, 89.17it/s]
100%|      | 30/30 [00:00<00:00, 102.03it/s]
100%|      | 30/30 [00:00<00:00, 99.20it/s]
100%|      | 30/30 [00:00<00:00, 108.63it/s]
100%|      | 30/30 [00:00<00:00, 102.74it/s]
100%|      | 30/30 [00:00<00:00, 97.34it/s]
100%|      | 30/30 [00:00<00:00, 100.48it/s]
100%|      | 30/30 [00:00<00:00, 95.10it/s]
100%|      | 30/30 [00:00<00:00, 88.44it/s]
100%|      | 30/30 [00:00<00:00, 95.41it/s]
100%|      | 30/30 [00:00<00:00, 91.45it/s]
100%|      | 30/30 [00:00<00:00, 96.62it/s]
100%|      | 30/30 [00:00<00:00, 103.19it/s]
100%|      | 30/30 [00:00<00:00, 91.02it/s]
100%|      | 30/30 [00:00<00:00, 100.94it/s]
100%|      | 30/30 [00:00<00:00, 108.96it/s]
100%|      | 30/30 [00:00<00:00, 108.42it/s]
100%|      | 30/30 [00:00<00:00, 103.82it/s]
100%|      | 30/30 [00:00<00:00, 99.27it/s]
100%|      | 30/30 [00:00<00:00, 106.83it/s]
100%|      | 30/30 [00:00<00:00, 101.96it/s]
100%|      | 30/30 [00:00<00:00, 103.50it/s]
100%|      | 30/30 [00:00<00:00, 104.52it/s]
100%|      | 30/30 [00:00<00:00, 105.24it/s]
100%|      | 30/30 [00:00<00:00, 88.72it/s]
```

```
100%|      | 30/30 [00:00<00:00, 81.02it/s]
100%|      | 30/30 [00:00<00:00, 100.65it/s]
100%|      | 30/30 [00:00<00:00, 100.22it/s]
100%|      | 30/30 [00:00<00:00, 91.98it/s]
100%|      | 30/30 [00:00<00:00, 95.77it/s]
100%|      | 30/30 [00:00<00:00, 102.09it/s]
100%|      | 30/30 [00:00<00:00, 94.40it/s]
100%|      | 30/30 [00:00<00:00, 105.92it/s]
100%|      | 30/30 [00:00<00:00, 107.30it/s]
100%|      | 30/30 [00:00<00:00, 100.65it/s]
100%|      | 30/30 [00:00<00:00, 97.60it/s]
100%|      | 30/30 [00:00<00:00, 96.36it/s]
100%|      | 30/30 [00:00<00:00, 98.72it/s]
100%|      | 30/30 [00:00<00:00, 103.70it/s]
100%|      | 30/30 [00:00<00:00, 99.40it/s]
100%|      | 30/30 [00:00<00:00, 102.54it/s]
100%|      | 30/30 [00:00<00:00, 101.64it/s]
100%|      | 30/30 [00:00<00:00, 101.63it/s]
100%|      | 30/30 [00:00<00:00, 107.29it/s]
100%|      | 30/30 [00:00<00:00, 103.68it/s]
100%|      | 30/30 [00:00<00:00, 94.21it/s]

Accuracy - random_guided_warp: 0.7744444444444445

100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.51it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.07it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.47it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.49it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
100%|      | 30/30 [00:03<00:00,  8.08it/s]
100%|      | 30/30 [00:03<00:00,  8.52it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  7.99it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.14it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.04it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]

Accuracy - discriminative_guided_warp: 0.7855555555555556
```

Random Forest Classifier

[ ]:
```
rfc=RandomForestClassifier(n_jobs=-1,random_state=123)
method_apply(rfc, x_train, y_train, x_test, y_test)
```

```
Accuracy - None: 0.8711111111111111
Accuracy - jitter: 0.9266666666666666
Accuracy - scaling: 0.9344444444444444
Accuracy - rotation: 0.7811111111111111

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray
```

```
Accuracy - permutation: 0.8355555555555556
Accuracy - magnitude_warp: 0.9466666666666667
Accuracy - time_warp: 0.9544444444444444
Accuracy - window_slice: 0.9911111111111112
Accuracy - window_warp: 0.9511111111111111
```

```
100%|      | 30/30 [00:00<00:00, 90.03it/s]
100%|      | 30/30 [00:00<00:00, 86.49it/s]
100%|      | 30/30 [00:00<00:00, 96.65it/s]
100%|      | 30/30 [00:00<00:00, 75.63it/s]
100%|      | 30/30 [00:00<00:00, 91.07it/s]
100%|      | 30/30 [00:00<00:00, 86.36it/s]
100%|      | 30/30 [00:00<00:00, 83.37it/s]
100%|      | 30/30 [00:00<00:00, 99.91it/s]
100%|      | 30/30 [00:00<00:00, 87.28it/s]
100%|      | 30/30 [00:00<00:00, 96.43it/s]
100%|      | 30/30 [00:00<00:00, 88.84it/s]
100%|      | 30/30 [00:00<00:00, 91.04it/s]
100%|      | 30/30 [00:00<00:00, 92.35it/s]
100%|      | 30/30 [00:00<00:00, 92.07it/s]
100%|      | 30/30 [00:00<00:00, 97.29it/s]
100%|      | 30/30 [00:00<00:00, 81.46it/s]
100%|      | 30/30 [00:00<00:00, 96.50it/s]
100%|      | 30/30 [00:00<00:00, 78.17it/s]
100%|      | 30/30 [00:00<00:00, 99.85it/s]
100%|      | 30/30 [00:00<00:00, 94.14it/s]
100%|      | 30/30 [00:00<00:00, 100.65it/s]
100%|      | 30/30 [00:00<00:00, 98.49it/s]
100%|      | 30/30 [00:00<00:00, 95.86it/s]
100%|      | 30/30 [00:00<00:00, 88.36it/s]
100%|      | 30/30 [00:00<00:00, 84.86it/s]
100%|      | 30/30 [00:00<00:00, 84.64it/s]
100%|      | 30/30 [00:00<00:00, 84.47it/s]
100%|      | 30/30 [00:00<00:00, 89.86it/s]
100%|      | 30/30 [00:00<00:00, 94.52it/s]
100%|      | 30/30 [00:00<00:00, 90.15it/s]
100%|      | 30/30 [00:00<00:00, 97.00it/s]
100%|      | 30/30 [00:00<00:00, 80.51it/s]
100%|      | 30/30 [00:00<00:00, 93.36it/s]
100%|      | 30/30 [00:00<00:00, 100.88it/s]
100%|      | 30/30 [00:00<00:00, 86.80it/s]
100%|      | 30/30 [00:00<00:00, 93.45it/s]
100%|      | 30/30 [00:00<00:00, 96.07it/s]
100%|      | 30/30 [00:00<00:00, 84.33it/s]
100%|      | 30/30 [00:00<00:00, 78.21it/s]
100%|      | 30/30 [00:00<00:00, 91.66it/s]
100%|      | 30/30 [00:00<00:00, 79.42it/s]
100%|      | 30/30 [00:00<00:00, 95.27it/s]
```

```
100%|      | 30/30 [00:00<00:00, 92.14it/s]
100%|      | 30/30 [00:00<00:00, 86.07it/s]
100%|      | 30/30 [00:00<00:00, 97.33it/s]
100%|      | 30/30 [00:00<00:00, 83.06it/s]
100%|      | 30/30 [00:00<00:00, 82.74it/s]
100%|      | 30/30 [00:00<00:00, 100.05it/s]
100%|      | 30/30 [00:00<00:00, 100.82it/s]
100%|      | 30/30 [00:00<00:00, 95.54it/s]
100%|      | 30/30 [00:00<00:00, 103.17it/s]
100%|      | 30/30 [00:00<00:00, 102.06it/s]
100%|      | 30/30 [00:00<00:00, 92.08it/s]
100%|      | 30/30 [00:00<00:00, 100.67it/s]
100%|      | 30/30 [00:00<00:00, 103.36it/s]
100%|      | 30/30 [00:00<00:00, 98.61it/s]
100%|      | 30/30 [00:00<00:00, 90.60it/s]
100%|      | 30/30 [00:00<00:00, 90.16it/s]
100%|      | 30/30 [00:00<00:00, 80.93it/s]
100%|      | 30/30 [00:00<00:00, 92.76it/s]
100%|      | 30/30 [00:00<00:00, 95.52it/s]
100%|      | 30/30 [00:00<00:00, 91.73it/s]
100%|      | 30/30 [00:00<00:00, 100.85it/s]
100%|      | 30/30 [00:00<00:00, 101.61it/s]
100%|      | 30/30 [00:00<00:00, 99.50it/s]
100%|      | 30/30 [00:00<00:00, 85.93it/s]
100%|      | 30/30 [00:00<00:00, 87.06it/s]
100%|      | 30/30 [00:00<00:00, 81.49it/s]
100%|      | 30/30 [00:00<00:00, 85.94it/s]
100%|      | 30/30 [00:00<00:00, 84.60it/s]
100%|      | 30/30 [00:00<00:00, 87.26it/s]
100%|      | 30/30 [00:00<00:00, 94.83it/s]
100%|      | 30/30 [00:00<00:00, 90.85it/s]
100%|      | 30/30 [00:00<00:00, 84.72it/s]
100%|      | 30/30 [00:00<00:00, 86.38it/s]
100%|      | 30/30 [00:00<00:00, 85.15it/s]
100%|      | 30/30 [00:00<00:00, 92.69it/s]
100%|      | 30/30 [00:00<00:00, 87.05it/s]
100%|      | 30/30 [00:00<00:00, 99.53it/s]
100%|      | 30/30 [00:00<00:00, 93.87it/s]
100%|      | 30/30 [00:00<00:00, 101.28it/s]
100%|      | 30/30 [00:00<00:00, 91.53it/s]
100%|      | 30/30 [00:00<00:00, 82.30it/s]
100%|      | 30/30 [00:00<00:00, 91.10it/s]
100%|      | 30/30 [00:00<00:00, 82.12it/s]
100%|      | 30/30 [00:00<00:00, 89.01it/s]
100%|      | 30/30 [00:00<00:00, 86.87it/s]
100%|      | 30/30 [00:00<00:00, 99.42it/s]
100%|      | 30/30 [00:00<00:00, 77.47it/s]
100%|      | 30/30 [00:00<00:00, 97.70it/s]
```

```
100%|      | 30/30 [00:00<00:00, 94.79it/s]
100%|      | 30/30 [00:00<00:00, 86.85it/s]
100%|      | 30/30 [00:00<00:00, 103.65it/s]
100%|      | 30/30 [00:00<00:00, 82.54it/s]
100%|      | 30/30 [00:00<00:00, 88.13it/s]
100%|      | 30/30 [00:00<00:00, 88.72it/s]
100%|      | 30/30 [00:00<00:00, 81.61it/s]
100%|      | 30/30 [00:00<00:00, 93.03it/s]
100%|      | 30/30 [00:00<00:00, 90.35it/s]

Accuracy - spawner: 0.9488888888888889

100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.59it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.59it/s]
100%|      | 30/30 [00:08<00:00,  3.61it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.59it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.43it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
```

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100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.44it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
```

```
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.59it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
```

```
Accuracy - wdba: 0.9055555555555556
```

```
100%|      | 30/30 [00:00<00:00, 84.70it/s]
100%|      | 30/30 [00:00<00:00, 76.30it/s]
100%|      | 30/30 [00:00<00:00, 86.83it/s]
100%|      | 30/30 [00:00<00:00, 100.37it/s]
100%|      | 30/30 [00:00<00:00, 82.27it/s]
100%|      | 30/30 [00:00<00:00, 81.81it/s]
100%|      | 30/30 [00:00<00:00, 85.68it/s]
100%|      | 30/30 [00:00<00:00, 92.28it/s]
100%|      | 30/30 [00:00<00:00, 98.22it/s]
100%|      | 30/30 [00:00<00:00, 88.50it/s]
100%|      | 30/30 [00:00<00:00, 86.09it/s]
100%|      | 30/30 [00:00<00:00, 88.00it/s]
100%|      | 30/30 [00:00<00:00, 99.63it/s]
100%|      | 30/30 [00:00<00:00, 81.83it/s]
100%|      | 30/30 [00:00<00:00, 88.23it/s]
100%|      | 30/30 [00:00<00:00, 97.11it/s]
100%|      | 30/30 [00:00<00:00, 85.21it/s]
100%|      | 30/30 [00:00<00:00, 91.56it/s]
100%|      | 30/30 [00:00<00:00, 83.34it/s]
100%|      | 30/30 [00:00<00:00, 85.11it/s]
100%|      | 30/30 [00:00<00:00, 96.31it/s]
100%|      | 30/30 [00:00<00:00, 80.26it/s]
100%|      | 30/30 [00:00<00:00, 79.26it/s]
100%|      | 30/30 [00:00<00:00, 102.50it/s]
100%|      | 30/30 [00:00<00:00, 97.59it/s]
100%|      | 30/30 [00:00<00:00, 86.19it/s]
100%|      | 30/30 [00:00<00:00, 101.43it/s]
100%|      | 30/30 [00:00<00:00, 96.76it/s]
100%|      | 30/30 [00:00<00:00, 81.78it/s]
100%|      | 30/30 [00:00<00:00, 80.19it/s]
100%|      | 30/30 [00:00<00:00, 84.76it/s]
100%|      | 30/30 [00:00<00:00, 98.30it/s]
```

```
100%|      | 30/30 [00:00<00:00, 94.88it/s]
100%|      | 30/30 [00:00<00:00, 83.63it/s]
100%|      | 30/30 [00:00<00:00, 87.03it/s]
100%|      | 30/30 [00:00<00:00, 96.04it/s]
100%|      | 30/30 [00:00<00:00, 87.57it/s]
100%|      | 30/30 [00:00<00:00, 91.15it/s]
100%|      | 30/30 [00:00<00:00, 91.16it/s]
100%|      | 30/30 [00:00<00:00, 82.49it/s]
100%|      | 30/30 [00:00<00:00, 86.48it/s]
100%|      | 30/30 [00:00<00:00, 94.16it/s]
100%|      | 30/30 [00:00<00:00, 79.25it/s]
100%|      | 30/30 [00:00<00:00, 85.01it/s]
100%|      | 30/30 [00:00<00:00, 98.59it/s]
100%|      | 30/30 [00:00<00:00, 91.89it/s]
100%|      | 30/30 [00:00<00:00, 82.16it/s]
100%|      | 30/30 [00:00<00:00, 90.91it/s]
100%|      | 30/30 [00:00<00:00, 86.50it/s]
100%|      | 30/30 [00:00<00:00, 83.63it/s]
100%|      | 30/30 [00:00<00:00, 84.26it/s]
100%|      | 30/30 [00:00<00:00, 86.34it/s]
100%|      | 30/30 [00:00<00:00, 98.82it/s]
100%|      | 30/30 [00:00<00:00, 79.33it/s]
100%|      | 30/30 [00:00<00:00, 87.28it/s]
100%|      | 30/30 [00:00<00:00, 94.57it/s]
100%|      | 30/30 [00:00<00:00, 91.71it/s]
100%|      | 30/30 [00:00<00:00, 84.92it/s]
100%|      | 30/30 [00:00<00:00, 97.54it/s]
100%|      | 30/30 [00:00<00:00, 79.72it/s]
100%|      | 30/30 [00:00<00:00, 89.90it/s]
100%|      | 30/30 [00:00<00:00, 86.58it/s]
100%|      | 30/30 [00:00<00:00, 85.22it/s]
100%|      | 30/30 [00:00<00:00, 92.50it/s]
100%|      | 30/30 [00:00<00:00, 98.63it/s]
100%|      | 30/30 [00:00<00:00, 86.70it/s]
100%|      | 30/30 [00:00<00:00, 97.52it/s]
100%|      | 30/30 [00:00<00:00, 97.13it/s]
100%|      | 30/30 [00:00<00:00, 90.95it/s]
100%|      | 30/30 [00:00<00:00, 84.97it/s]
100%|      | 30/30 [00:00<00:00, 86.29it/s]
100%|      | 30/30 [00:00<00:00, 82.24it/s]
100%|      | 30/30 [00:00<00:00, 98.47it/s]
100%|      | 30/30 [00:00<00:00, 99.93it/s]
100%|      | 30/30 [00:00<00:00, 86.01it/s]
100%|      | 30/30 [00:00<00:00, 101.09it/s]
100%|      | 30/30 [00:00<00:00, 101.26it/s]
100%|      | 30/30 [00:00<00:00, 78.26it/s]
100%|      | 30/30 [00:00<00:00, 87.11it/s]
100%|      | 30/30 [00:00<00:00, 80.01it/s]
```

```
100%|      | 30/30 [00:00<00:00, 80.90it/s]
100%|      | 30/30 [00:00<00:00, 95.01it/s]
100%|      | 30/30 [00:00<00:00, 100.63it/s]
100%|      | 30/30 [00:00<00:00, 85.93it/s]
100%|      | 30/30 [00:00<00:00, 90.15it/s]
100%|      | 30/30 [00:00<00:00, 77.21it/s]
100%|      | 30/30 [00:00<00:00, 94.54it/s]
100%|      | 30/30 [00:00<00:00, 101.94it/s]
100%|      | 30/30 [00:00<00:00, 98.13it/s]
100%|      | 30/30 [00:00<00:00, 83.21it/s]
100%|      | 30/30 [00:00<00:00, 97.48it/s]
100%|      | 30/30 [00:00<00:00, 79.61it/s]
100%|      | 30/30 [00:00<00:00, 77.61it/s]
100%|      | 30/30 [00:00<00:00, 75.98it/s]
100%|      | 30/30 [00:00<00:00, 86.41it/s]
100%|      | 30/30 [00:00<00:00, 90.98it/s]
100%|      | 30/30 [00:00<00:00, 83.27it/s]
100%|      | 30/30 [00:00<00:00, 91.39it/s]
100%|      | 30/30 [00:00<00:00, 86.97it/s]
```

```
Accuracy - random_guided_warp: 0.9677777777777777
```

```
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:03<00:00,  7.65it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:03<00:00,  7.69it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.73it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:04<00:00,  7.34it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.71it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.62it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:04<00:00,  7.32it/s]
```

```
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:03<00:00,  7.63it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:03<00:00,  7.63it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:04<00:00,  7.37it/s]
100%|      | 30/30 [00:04<00:00,  7.27it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:03<00:00,  7.77it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:03<00:00,  7.65it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:04<00:00,  7.42it/s]
100%|      | 30/30 [00:03<00:00,  7.84it/s]
100%|      | 30/30 [00:03<00:00,  7.65it/s]
100%|      | 30/30 [00:03<00:00,  7.74it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:04<00:00,  7.24it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:04<00:00,  7.31it/s]
100%|      | 30/30 [00:03<00:00,  7.65it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.50it/s]
100%|      | 30/30 [00:04<00:00,  7.42it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:04<00:00,  7.35it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
```

```
100%|      | 30/30 [00:04<00:00,  7.42it/s]
100%|      | 30/30 [00:03<00:00,  7.77it/s]
100%|      | 30/30 [00:04<00:00,  7.50it/s]
100%|      | 30/30 [00:03<00:00,  7.50it/s]
100%|      | 30/30 [00:03<00:00,  7.70it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.66it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.63it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:03<00:00,  7.68it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]

Accuracy - discriminative_guided_warp: 0.9888888888888889
```

K-NearestNeighbours Classifier

[ ]:
```
knn = KNeighborsClassifier()
method_apply(knn, x_train, y_train, x_test, y_test)
```

```
Accuracy - None: 0.7666666666666667
Accuracy - jitter: 0.8533333333333334
Accuracy - scaling: 0.85
Accuracy - rotation: 0.8522222222222222

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Accuracy - permutation: 0.8377777777777777
Accuracy - magnitude_warp: 0.8477777777777777
```

```
Accuracy - time_warp: 0.9955555555555555
Accuracy - window_slice: 0.9733333333333334
Accuracy - window_warp: 0.9655555555555555

100%|      | 30/30 [00:00<00:00, 102.16it/s]
100%|      | 30/30 [00:00<00:00, 95.04it/s]
100%|      | 30/30 [00:00<00:00, 96.65it/s]
100%|      | 30/30 [00:00<00:00, 95.50it/s]
100%|      | 30/30 [00:00<00:00, 97.11it/s]
100%|      | 30/30 [00:00<00:00, 107.40it/s]
100%|      | 30/30 [00:00<00:00, 111.32it/s]
100%|      | 30/30 [00:00<00:00, 106.68it/s]
100%|      | 30/30 [00:00<00:00, 100.86it/s]
100%|      | 30/30 [00:00<00:00, 112.99it/s]
100%|      | 30/30 [00:00<00:00, 102.14it/s]
100%|      | 30/30 [00:00<00:00, 107.90it/s]
100%|      | 30/30 [00:00<00:00, 102.92it/s]
100%|      | 30/30 [00:00<00:00, 108.63it/s]
100%|      | 30/30 [00:00<00:00, 102.12it/s]
100%|      | 30/30 [00:00<00:00, 89.31it/s]
100%|      | 30/30 [00:00<00:00, 100.31it/s]
100%|      | 30/30 [00:00<00:00, 107.23it/s]
100%|      | 30/30 [00:00<00:00, 108.64it/s]
100%|      | 30/30 [00:00<00:00, 108.05it/s]
100%|      | 30/30 [00:00<00:00, 109.88it/s]
100%|      | 30/30 [00:00<00:00, 100.52it/s]
100%|      | 30/30 [00:00<00:00, 102.39it/s]
100%|      | 30/30 [00:00<00:00, 107.23it/s]
100%|      | 30/30 [00:00<00:00, 107.57it/s]
100%|      | 30/30 [00:00<00:00, 92.99it/s]
100%|      | 30/30 [00:00<00:00, 92.23it/s]
100%|      | 30/30 [00:00<00:00, 100.37it/s]
100%|      | 30/30 [00:00<00:00, 110.19it/s]
100%|      | 30/30 [00:00<00:00, 101.79it/s]
100%|      | 30/30 [00:00<00:00, 107.96it/s]
100%|      | 30/30 [00:00<00:00, 97.39it/s]
100%|      | 30/30 [00:00<00:00, 105.49it/s]
100%|      | 30/30 [00:00<00:00, 109.65it/s]
100%|      | 30/30 [00:00<00:00, 110.27it/s]
100%|      | 30/30 [00:00<00:00, 101.35it/s]
100%|      | 30/30 [00:00<00:00, 105.17it/s]
100%|      | 30/30 [00:00<00:00, 99.76it/s]
100%|      | 30/30 [00:00<00:00, 103.06it/s]
100%|      | 30/30 [00:00<00:00, 91.32it/s]
100%|      | 30/30 [00:00<00:00, 97.01it/s]
100%|      | 30/30 [00:00<00:00, 102.69it/s]
100%|      | 30/30 [00:00<00:00, 104.51it/s]
100%|      | 30/30 [00:00<00:00, 102.90it/s]
```

```
100%|      | 30/30 [00:00<00:00, 99.97it/s]
100%|      | 30/30 [00:00<00:00, 103.33it/s]
100%|      | 30/30 [00:00<00:00, 104.30it/s]
100%|      | 30/30 [00:00<00:00, 104.88it/s]
100%|      | 30/30 [00:00<00:00, 99.63it/s]
100%|      | 30/30 [00:00<00:00, 104.89it/s]
100%|      | 30/30 [00:00<00:00, 104.06it/s]
100%|      | 30/30 [00:00<00:00, 97.23it/s]
100%|      | 30/30 [00:00<00:00, 98.11it/s]
100%|      | 30/30 [00:00<00:00, 102.44it/s]
100%|      | 30/30 [00:00<00:00, 102.15it/s]
100%|      | 30/30 [00:00<00:00, 98.26it/s]
100%|      | 30/30 [00:00<00:00, 96.86it/s]
100%|      | 30/30 [00:00<00:00, 101.40it/s]
100%|      | 30/30 [00:00<00:00, 108.56it/s]
100%|      | 30/30 [00:00<00:00, 104.17it/s]
100%|      | 30/30 [00:00<00:00, 101.92it/s]
100%|      | 30/30 [00:00<00:00, 101.57it/s]
100%|      | 30/30 [00:00<00:00, 96.08it/s]
100%|      | 30/30 [00:00<00:00, 107.50it/s]
100%|      | 30/30 [00:00<00:00, 104.95it/s]
100%|      | 30/30 [00:00<00:00, 108.05it/s]
100%|      | 30/30 [00:00<00:00, 94.45it/s]
100%|      | 30/30 [00:00<00:00, 101.38it/s]
100%|      | 30/30 [00:00<00:00, 102.58it/s]
100%|      | 30/30 [00:00<00:00, 96.25it/s]
100%|      | 30/30 [00:00<00:00, 94.86it/s]
100%|      | 30/30 [00:00<00:00, 101.80it/s]
100%|      | 30/30 [00:00<00:00, 98.24it/s]
100%|      | 30/30 [00:00<00:00, 99.90it/s]
100%|      | 30/30 [00:00<00:00, 99.70it/s]
100%|      | 30/30 [00:00<00:00, 95.79it/s]
100%|      | 30/30 [00:00<00:00, 101.57it/s]
100%|      | 30/30 [00:00<00:00, 107.24it/s]
100%|      | 30/30 [00:00<00:00, 109.61it/s]
100%|      | 30/30 [00:00<00:00, 95.65it/s]
100%|      | 30/30 [00:00<00:00, 103.52it/s]
100%|      | 30/30 [00:00<00:00, 103.05it/s]
100%|      | 30/30 [00:00<00:00, 90.86it/s]
100%|      | 30/30 [00:00<00:00, 107.53it/s]
100%|      | 30/30 [00:00<00:00, 109.95it/s]
100%|      | 30/30 [00:00<00:00, 107.64it/s]
100%|      | 30/30 [00:00<00:00, 104.28it/s]
100%|      | 30/30 [00:00<00:00, 98.23it/s]
100%|      | 30/30 [00:00<00:00, 90.30it/s]
100%|      | 30/30 [00:00<00:00, 92.82it/s]
100%|      | 30/30 [00:00<00:00, 98.99it/s]
100%|      | 30/30 [00:00<00:00, 103.97it/s]
```

```
100%|      | 30/30 [00:00<00:00, 90.93it/s]
100%|      | 30/30 [00:00<00:00, 102.87it/s]
100%|      | 30/30 [00:00<00:00, 102.30it/s]
100%|      | 30/30 [00:00<00:00, 108.51it/s]
100%|      | 30/30 [00:00<00:00, 102.51it/s]
100%|      | 30/30 [00:00<00:00, 108.88it/s]
100%|      | 30/30 [00:00<00:00, 101.49it/s]
```

```
Accuracy - spawner: 0.9133333333333333
```

```
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
```

```
Accuracy - wdba: 0.8377777777777777
```

```
100%|      | 30/30 [00:00<00:00, 99.87it/s]
100%|      | 30/30 [00:00<00:00, 108.95it/s]
100%|      | 30/30 [00:00<00:00, 102.10it/s]
100%|      | 30/30 [00:00<00:00, 103.43it/s]
100%|      | 30/30 [00:00<00:00, 104.15it/s]
100%|      | 30/30 [00:00<00:00, 100.25it/s]
100%|      | 30/30 [00:00<00:00, 94.20it/s]
100%|      | 30/30 [00:00<00:00, 93.89it/s]
100%|      | 30/30 [00:00<00:00, 102.09it/s]
100%|      | 30/30 [00:00<00:00, 106.08it/s]
100%|      | 30/30 [00:00<00:00, 103.67it/s]
100%|      | 30/30 [00:00<00:00, 98.23it/s]
100%|      | 30/30 [00:00<00:00, 101.96it/s]
100%|      | 30/30 [00:00<00:00, 100.53it/s]
100%|      | 30/30 [00:00<00:00, 98.40it/s]
100%|      | 30/30 [00:00<00:00, 101.98it/s]
100%|      | 30/30 [00:00<00:00, 104.63it/s]
100%|      | 30/30 [00:00<00:00, 96.95it/s]
100%|      | 30/30 [00:00<00:00, 105.65it/s]
100%|      | 30/30 [00:00<00:00, 105.74it/s]
100%|      | 30/30 [00:00<00:00, 98.42it/s]
100%|      | 30/30 [00:00<00:00, 96.68it/s]
100%|      | 30/30 [00:00<00:00, 101.59it/s]
100%|      | 30/30 [00:00<00:00, 103.81it/s]
100%|      | 30/30 [00:00<00:00, 96.75it/s]
100%|      | 30/30 [00:00<00:00, 108.18it/s]
100%|      | 30/30 [00:00<00:00, 101.63it/s]
100%|      | 30/30 [00:00<00:00, 95.26it/s]
100%|      | 30/30 [00:00<00:00, 97.10it/s]
100%|      | 30/30 [00:00<00:00, 100.44it/s]
100%|      | 30/30 [00:00<00:00, 101.16it/s]
100%|      | 30/30 [00:00<00:00, 101.27it/s]
100%|      | 30/30 [00:00<00:00, 97.38it/s]
100%|      | 30/30 [00:00<00:00, 93.87it/s]
```

```
100%|      | 30/30 [00:00<00:00, 101.41it/s]
100%|      | 30/30 [00:00<00:00, 100.77it/s]
100%|      | 30/30 [00:00<00:00, 99.07it/s]
100%|      | 30/30 [00:00<00:00, 106.10it/s]
100%|      | 30/30 [00:00<00:00, 108.99it/s]
100%|      | 30/30 [00:00<00:00, 100.94it/s]
100%|      | 30/30 [00:00<00:00, 97.81it/s]
100%|      | 30/30 [00:00<00:00, 99.33it/s]
100%|      | 30/30 [00:00<00:00, 102.21it/s]
100%|      | 30/30 [00:00<00:00, 83.07it/s]
100%|      | 30/30 [00:00<00:00, 101.20it/s]
100%|      | 30/30 [00:00<00:00, 104.53it/s]
100%|      | 30/30 [00:00<00:00, 105.36it/s]
100%|      | 30/30 [00:00<00:00, 107.77it/s]
100%|      | 30/30 [00:00<00:00, 96.27it/s]
100%|      | 30/30 [00:00<00:00, 100.54it/s]
100%|      | 30/30 [00:00<00:00, 100.27it/s]
100%|      | 30/30 [00:00<00:00, 108.45it/s]
100%|      | 30/30 [00:00<00:00, 101.66it/s]
100%|      | 30/30 [00:00<00:00, 93.14it/s]
100%|      | 30/30 [00:00<00:00, 95.12it/s]
100%|      | 30/30 [00:00<00:00, 95.23it/s]
100%|      | 30/30 [00:00<00:00, 90.08it/s]
100%|      | 30/30 [00:00<00:00, 95.99it/s]
100%|      | 30/30 [00:00<00:00, 95.13it/s]
100%|      | 30/30 [00:00<00:00, 103.63it/s]
100%|      | 30/30 [00:00<00:00, 97.51it/s]
100%|      | 30/30 [00:00<00:00, 100.18it/s]
100%|      | 30/30 [00:00<00:00, 104.21it/s]
100%|      | 30/30 [00:00<00:00, 94.87it/s]
100%|      | 30/30 [00:00<00:00, 105.80it/s]
100%|      | 30/30 [00:00<00:00, 107.89it/s]
100%|      | 30/30 [00:00<00:00, 99.50it/s]
100%|      | 30/30 [00:00<00:00, 95.92it/s]
100%|      | 30/30 [00:00<00:00, 100.11it/s]
100%|      | 30/30 [00:00<00:00, 94.09it/s]
100%|      | 30/30 [00:00<00:00, 85.38it/s]
100%|      | 30/30 [00:00<00:00, 99.22it/s]
100%|      | 30/30 [00:00<00:00, 103.24it/s]
100%|      | 30/30 [00:00<00:00, 97.95it/s]
100%|      | 30/30 [00:00<00:00, 105.33it/s]
100%|      | 30/30 [00:00<00:00, 102.13it/s]
100%|      | 30/30 [00:00<00:00, 84.77it/s]
100%|      | 30/30 [00:00<00:00, 94.28it/s]
100%|      | 30/30 [00:00<00:00, 108.54it/s]
100%|      | 30/30 [00:00<00:00, 99.86it/s]
100%|      | 30/30 [00:00<00:00, 109.81it/s]
100%|      | 30/30 [00:00<00:00, 108.53it/s]
```

```
100%|      | 30/30 [00:00<00:00, 100.21it/s]
100%|      | 30/30 [00:00<00:00, 102.55it/s]
100%|      | 30/30 [00:00<00:00, 93.93it/s]
100%|      | 30/30 [00:00<00:00, 107.72it/s]
100%|      | 30/30 [00:00<00:00, 102.53it/s]
100%|      | 30/30 [00:00<00:00, 104.65it/s]
100%|      | 30/30 [00:00<00:00, 96.46it/s]
100%|      | 30/30 [00:00<00:00, 86.82it/s]
100%|      | 30/30 [00:00<00:00, 94.72it/s]
100%|      | 30/30 [00:00<00:00, 96.23it/s]
100%|      | 30/30 [00:00<00:00, 94.47it/s]
100%|      | 30/30 [00:00<00:00, 107.26it/s]
100%|      | 30/30 [00:00<00:00, 108.10it/s]
100%|      | 30/30 [00:00<00:00, 100.33it/s]
100%|      | 30/30 [00:00<00:00, 97.22it/s]
100%|      | 30/30 [00:00<00:00, 98.84it/s]
100%|      | 30/30 [00:00<00:00, 96.18it/s]

Accuracy - random_guided_warp: 0.93

100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.52it/s]
100%|      | 30/30 [00:03<00:00,  8.64it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.48it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.52it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.60it/s]
100%|      | 30/30 [00:03<00:00,  8.56it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.48it/s]
100%|      | 30/30 [00:03<00:00,  8.47it/s]
100%|      | 30/30 [00:03<00:00,  8.52it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.48it/s]
100%|      | 30/30 [00:03<00:00,  8.67it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.49it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.57it/s]
100%|      | 30/30 [00:03<00:00,  8.52it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.51it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.53it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.51it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.57it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.50it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:04<00:00,  6.72it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.52it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.53it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]

Accuracy - discriminative_guided_warp: 0.9777777777777777
```

Ada Boost

[ ]:
```
ada_model = AdaBoostClassifier(n_estimators=200, random_state=44)
method_apply(ada_model, x_train, y_train, x_test, y_test)
```

```
Accuracy - None: 0.81
Accuracy - jitter: 0.8066666666666666
Accuracy - scaling: 0.7333333333333333
Accuracy - rotation: 0.4855555555555556

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Accuracy - permutation: 0.49333333333333335
Accuracy - magnitude_warp: 0.7933333333333333
Accuracy - time_warp: 0.6588888888888889
Accuracy - window_slice: 0.8133333333333334
```

```
Accuracy - window_warp: 0.8155555555555556
100%|      | 30/30 [00:00<00:00, 92.19it/s]
100%|      | 30/30 [00:00<00:00, 91.82it/s]
100%|      | 30/30 [00:00<00:00, 91.97it/s]
100%|      | 30/30 [00:00<00:00, 90.27it/s]
100%|      | 30/30 [00:00<00:00, 83.59it/s]
100%|      | 30/30 [00:00<00:00, 84.53it/s]
100%|      | 30/30 [00:00<00:00, 97.35it/s]
100%|      | 30/30 [00:00<00:00, 91.21it/s]
100%|      | 30/30 [00:00<00:00, 82.86it/s]
100%|      | 30/30 [00:00<00:00, 99.55it/s]
100%|      | 30/30 [00:00<00:00, 88.84it/s]
100%|      | 30/30 [00:00<00:00, 79.18it/s]
100%|      | 30/30 [00:00<00:00, 90.41it/s]
100%|      | 30/30 [00:00<00:00, 75.50it/s]
100%|      | 30/30 [00:00<00:00, 85.16it/s]
100%|      | 30/30 [00:00<00:00, 77.86it/s]
100%|      | 30/30 [00:00<00:00, 84.56it/s]
100%|      | 30/30 [00:00<00:00, 80.48it/s]
100%|      | 30/30 [00:00<00:00, 91.97it/s]
100%|      | 30/30 [00:00<00:00, 90.51it/s]
100%|      | 30/30 [00:00<00:00, 83.26it/s]
100%|      | 30/30 [00:00<00:00, 102.91it/s]
100%|      | 30/30 [00:00<00:00, 94.03it/s]
100%|      | 30/30 [00:00<00:00, 93.80it/s]
100%|      | 30/30 [00:00<00:00, 94.44it/s]
100%|      | 30/30 [00:00<00:00, 95.22it/s]
100%|      | 30/30 [00:00<00:00, 85.32it/s]
100%|      | 30/30 [00:00<00:00, 81.92it/s]
100%|      | 30/30 [00:00<00:00, 92.89it/s]
100%|      | 30/30 [00:00<00:00, 96.53it/s]
100%|      | 30/30 [00:00<00:00, 84.87it/s]
100%|      | 30/30 [00:00<00:00, 83.58it/s]
100%|      | 30/30 [00:00<00:00, 88.36it/s]
100%|      | 30/30 [00:00<00:00, 95.35it/s]
100%|      | 30/30 [00:00<00:00, 98.45it/s]
100%|      | 30/30 [00:00<00:00, 87.25it/s]
100%|      | 30/30 [00:00<00:00, 85.09it/s]
100%|      | 30/30 [00:00<00:00, 94.27it/s]
100%|      | 30/30 [00:00<00:00, 100.47it/s]
100%|      | 30/30 [00:00<00:00, 83.10it/s]
100%|      | 30/30 [00:00<00:00, 85.37it/s]
100%|      | 30/30 [00:00<00:00, 83.63it/s]
100%|      | 30/30 [00:00<00:00, 90.29it/s]
100%|      | 30/30 [00:00<00:00, 93.66it/s]
100%|      | 30/30 [00:00<00:00, 95.23it/s]
100%|      | 30/30 [00:00<00:00, 97.60it/s]
```

```
100%|      | 30/30 [00:00<00:00, 83.98it/s]
100%|      | 30/30 [00:00<00:00, 88.39it/s]
100%|      | 30/30 [00:00<00:00, 92.81it/s]
100%|      | 30/30 [00:00<00:00, 91.81it/s]
100%|      | 30/30 [00:00<00:00, 79.98it/s]
100%|      | 30/30 [00:00<00:00, 83.36it/s]
100%|      | 30/30 [00:00<00:00, 83.54it/s]
100%|      | 30/30 [00:00<00:00, 90.25it/s]
100%|      | 30/30 [00:00<00:00, 91.10it/s]
100%|      | 30/30 [00:00<00:00, 87.66it/s]
100%|      | 30/30 [00:00<00:00, 98.75it/s]
100%|      | 30/30 [00:00<00:00, 100.47it/s]
100%|      | 30/30 [00:00<00:00, 91.28it/s]
100%|      | 30/30 [00:00<00:00, 97.35it/s]
100%|      | 30/30 [00:00<00:00, 97.41it/s]
100%|      | 30/30 [00:00<00:00, 89.80it/s]
100%|      | 30/30 [00:00<00:00, 88.39it/s]
100%|      | 30/30 [00:00<00:00, 90.53it/s]
100%|      | 30/30 [00:00<00:00, 97.51it/s]
100%|      | 30/30 [00:00<00:00, 101.68it/s]
100%|      | 30/30 [00:00<00:00, 96.86it/s]
100%|      | 30/30 [00:00<00:00, 97.53it/s]
100%|      | 30/30 [00:00<00:00, 77.68it/s]
100%|      | 30/30 [00:00<00:00, 94.37it/s]
100%|      | 30/30 [00:00<00:00, 89.95it/s]
100%|      | 30/30 [00:00<00:00, 92.85it/s]
100%|      | 30/30 [00:00<00:00, 97.60it/s]
100%|      | 30/30 [00:00<00:00, 92.46it/s]
100%|      | 30/30 [00:00<00:00, 87.46it/s]
100%|      | 30/30 [00:00<00:00, 95.82it/s]
100%|      | 30/30 [00:00<00:00, 99.62it/s]
100%|      | 30/30 [00:00<00:00, 74.10it/s]
100%|      | 30/30 [00:00<00:00, 100.60it/s]
100%|      | 30/30 [00:00<00:00, 95.94it/s]
100%|      | 30/30 [00:00<00:00, 91.37it/s]
100%|      | 30/30 [00:00<00:00, 88.53it/s]
100%|      | 30/30 [00:00<00:00, 82.25it/s]
100%|      | 30/30 [00:00<00:00, 99.63it/s]
100%|      | 30/30 [00:00<00:00, 103.25it/s]
100%|      | 30/30 [00:00<00:00, 82.96it/s]
100%|      | 30/30 [00:00<00:00, 94.43it/s]
100%|      | 30/30 [00:00<00:00, 102.38it/s]
100%|      | 30/30 [00:00<00:00, 97.90it/s]
100%|      | 30/30 [00:00<00:00, 93.63it/s]
100%|      | 30/30 [00:00<00:00, 93.00it/s]
100%|      | 30/30 [00:00<00:00, 102.62it/s]
100%|      | 30/30 [00:00<00:00, 100.94it/s]
100%|      | 30/30 [00:00<00:00, 90.38it/s]
```

```
100%|      | 30/30 [00:00<00:00, 90.87it/s]
100%|      | 30/30 [00:00<00:00, 93.87it/s]
100%|      | 30/30 [00:00<00:00, 90.65it/s]
100%|      | 30/30 [00:00<00:00, 93.35it/s]
100%|      | 30/30 [00:00<00:00, 87.99it/s]
```

```
Accuracy - spawner: 0.9011111111111111
```

```
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.60it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.59it/s]
100%|      | 30/30 [00:08<00:00,  3.59it/s]
100%|      | 30/30 [00:08<00:00,  3.62it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
```

```
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.59it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.63it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.45it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.62it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.59it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.63it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.42it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
```

```
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
```

```
Accuracy - wdba: 0.7033333333333334
```

```
100%|      | 30/30 [00:00<00:00, 92.84it/s]
100%|      | 30/30 [00:00<00:00, 81.51it/s]
100%|      | 30/30 [00:00<00:00, 91.39it/s]
100%|      | 30/30 [00:00<00:00, 94.02it/s]
100%|      | 30/30 [00:00<00:00, 96.62it/s]
100%|      | 30/30 [00:00<00:00, 94.39it/s]
100%|      | 30/30 [00:00<00:00, 95.15it/s]
100%|      | 30/30 [00:00<00:00, 89.34it/s]
100%|      | 30/30 [00:00<00:00, 91.26it/s]
100%|      | 30/30 [00:00<00:00, 89.81it/s]
100%|      | 30/30 [00:00<00:00, 94.33it/s]
100%|      | 30/30 [00:00<00:00, 90.00it/s]
100%|      | 30/30 [00:00<00:00, 89.49it/s]
100%|      | 30/30 [00:00<00:00, 86.59it/s]
100%|      | 30/30 [00:00<00:00, 93.51it/s]
100%|      | 30/30 [00:00<00:00, 82.20it/s]
100%|      | 30/30 [00:00<00:00, 84.94it/s]
100%|      | 30/30 [00:00<00:00, 100.41it/s]
100%|      | 30/30 [00:00<00:00, 94.50it/s]
100%|      | 30/30 [00:00<00:00, 93.37it/s]
100%|      | 30/30 [00:00<00:00, 89.47it/s]
100%|      | 30/30 [00:00<00:00, 87.45it/s]
100%|      | 30/30 [00:00<00:00, 96.75it/s]
100%|      | 30/30 [00:00<00:00, 93.40it/s]
100%|      | 30/30 [00:00<00:00, 85.34it/s]
100%|      | 30/30 [00:00<00:00, 89.50it/s]
100%|      | 30/30 [00:00<00:00, 94.73it/s]
100%|      | 30/30 [00:00<00:00, 99.74it/s]
100%|      | 30/30 [00:00<00:00, 91.85it/s]
100%|      | 30/30 [00:00<00:00, 99.92it/s]
100%|      | 30/30 [00:00<00:00, 97.73it/s]
100%|      | 30/30 [00:00<00:00, 95.24it/s]
100%|      | 30/30 [00:00<00:00, 86.07it/s]
100%|      | 30/30 [00:00<00:00, 83.38it/s]
100%|      | 30/30 [00:00<00:00, 94.09it/s]
100%|      | 30/30 [00:00<00:00, 97.05it/s]
```

```
100%|      | 30/30 [00:00<00:00, 94.66it/s]
100%|      | 30/30 [00:00<00:00, 83.34it/s]
100%|      | 30/30 [00:00<00:00, 84.05it/s]
100%|      | 30/30 [00:00<00:00, 86.28it/s]
100%|      | 30/30 [00:00<00:00, 84.41it/s]
100%|      | 30/30 [00:00<00:00, 92.48it/s]
100%|      | 30/30 [00:00<00:00, 90.81it/s]
100%|      | 30/30 [00:00<00:00, 100.81it/s]
100%|      | 30/30 [00:00<00:00, 90.61it/s]
100%|      | 30/30 [00:00<00:00, 84.55it/s]
100%|      | 30/30 [00:00<00:00, 81.91it/s]
100%|      | 30/30 [00:00<00:00, 91.16it/s]
100%|      | 30/30 [00:00<00:00, 81.30it/s]
100%|      | 30/30 [00:00<00:00, 90.95it/s]
100%|      | 30/30 [00:00<00:00, 88.56it/s]
100%|      | 30/30 [00:00<00:00, 91.83it/s]
100%|      | 30/30 [00:00<00:00, 90.16it/s]
100%|      | 30/30 [00:00<00:00, 99.76it/s]
100%|      | 30/30 [00:00<00:00, 77.90it/s]
100%|      | 30/30 [00:00<00:00, 89.93it/s]
100%|      | 30/30 [00:00<00:00, 97.59it/s]
100%|      | 30/30 [00:00<00:00, 83.94it/s]
100%|      | 30/30 [00:00<00:00, 79.72it/s]
100%|      | 30/30 [00:00<00:00, 73.66it/s]
100%|      | 30/30 [00:00<00:00, 96.59it/s]
100%|      | 30/30 [00:00<00:00, 88.62it/s]
100%|      | 30/30 [00:00<00:00, 85.07it/s]
100%|      | 30/30 [00:00<00:00, 96.16it/s]
100%|      | 30/30 [00:00<00:00, 95.55it/s]
100%|      | 30/30 [00:00<00:00, 81.79it/s]
100%|      | 30/30 [00:00<00:00, 86.44it/s]
100%|      | 30/30 [00:00<00:00, 91.73it/s]
100%|      | 30/30 [00:00<00:00, 89.44it/s]
100%|      | 30/30 [00:00<00:00, 99.36it/s]
100%|      | 30/30 [00:00<00:00, 92.61it/s]
100%|      | 30/30 [00:00<00:00, 80.89it/s]
100%|      | 30/30 [00:00<00:00, 97.73it/s]
100%|      | 30/30 [00:00<00:00, 100.11it/s]
100%|      | 30/30 [00:00<00:00, 90.35it/s]
100%|      | 30/30 [00:00<00:00, 90.75it/s]
100%|      | 30/30 [00:00<00:00, 91.62it/s]
100%|      | 30/30 [00:00<00:00, 89.13it/s]
100%|      | 30/30 [00:00<00:00, 86.91it/s]
100%|      | 30/30 [00:00<00:00, 85.02it/s]
100%|      | 30/30 [00:00<00:00, 92.77it/s]
100%|      | 30/30 [00:00<00:00, 88.84it/s]
100%|      | 30/30 [00:00<00:00, 104.00it/s]
100%|      | 30/30 [00:00<00:00, 87.34it/s]
```

```
100%|      | 30/30 [00:00<00:00, 85.34it/s]
100%|      | 30/30 [00:00<00:00, 90.39it/s]
100%|      | 30/30 [00:00<00:00, 83.25it/s]
100%|      | 30/30 [00:00<00:00, 92.44it/s]
100%|      | 30/30 [00:00<00:00, 101.03it/s]
100%|      | 30/30 [00:00<00:00, 86.78it/s]
100%|      | 30/30 [00:00<00:00, 99.86it/s]
100%|      | 30/30 [00:00<00:00, 100.89it/s]
100%|      | 30/30 [00:00<00:00, 88.81it/s]
100%|      | 30/30 [00:00<00:00, 86.27it/s]
100%|      | 30/30 [00:00<00:00, 105.35it/s]
100%|      | 30/30 [00:00<00:00, 101.10it/s]
100%|      | 30/30 [00:00<00:00, 92.42it/s]
100%|      | 30/30 [00:00<00:00, 100.04it/s]
100%|      | 30/30 [00:00<00:00, 91.67it/s]

Accuracy - random_guided_warp: 0.8011111111111111

100%|      | 30/30 [00:03<00:00,  7.72it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.72it/s]
100%|      | 30/30 [00:03<00:00,  7.75it/s]
100%|      | 30/30 [00:03<00:00,  7.77it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:03<00:00,  7.80it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.31it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:03<00:00,  7.76it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:04<00:00,  7.50it/s]
100%|      | 30/30 [00:03<00:00,  7.73it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:04<00:00,  7.37it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:03<00:00,  7.63it/s]
100%|      | 30/30 [00:03<00:00,  7.50it/s]
```

```
100%|      | 30/30 [00:03<00:00,  7.50it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:03<00:00,  7.50it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:03<00:00,  7.75it/s]
100%|      | 30/30 [00:03<00:00,  7.62it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:03<00:00,  7.69it/s]
100%|      | 30/30 [00:03<00:00,  7.71it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:03<00:00,  7.68it/s]
100%|      | 30/30 [00:04<00:00,  7.42it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:03<00:00,  7.81it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:03<00:00,  7.70it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:04<00:00,  7.38it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:03<00:00,  7.68it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:03<00:00,  7.66it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:03<00:00,  7.62it/s]
100%|      | 30/30 [00:03<00:00,  7.66it/s]
100%|      | 30/30 [00:04<00:00,  7.37it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
```

```
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:03<00:00,  7.66it/s]
100%|      | 30/30 [00:03<00:00,  7.86it/s]
100%|      | 30/30 [00:04<00:00,  7.37it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.72it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:03<00:00,  7.62it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:03<00:00,  7.67it/s]
100%|      | 30/30 [00:03<00:00,  7.67it/s]

Accuracy - discriminative_guided_warp: 0.8922222222222222
```

XGB Classifier

[ ]:
```
XGB = XGBClassifier(objective='binary:
 ↪logistic',scale_pos_weight=1,n_estimators=85, eta=0.3, subsample=1,␣
 ↪colsample_bytree=1)
method_apply(XGB, x_train, y_train, x_test, y_test)
```

```
Accuracy - None: 0.77
Accuracy - jitter: 0.8166666666666667
Accuracy - scaling: 0.8511111111111112
Accuracy - rotation: 0.5377777777777778

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Accuracy - permutation: 0.7288888888888889
Accuracy - magnitude_warp: 0.8
Accuracy - time_warp: 0.7477777777777778
Accuracy - window_slice: 0.9355555555555556
```

```
Accuracy - window_warp: 0.8833333333333333
```

```
100%|      | 30/30 [00:00<00:00, 104.35it/s]
100%|      | 30/30 [00:00<00:00, 95.20it/s]
100%|      | 30/30 [00:00<00:00, 100.46it/s]
100%|      | 30/30 [00:00<00:00, 102.48it/s]
100%|      | 30/30 [00:00<00:00, 102.07it/s]
100%|      | 30/30 [00:00<00:00, 100.35it/s]
100%|      | 30/30 [00:00<00:00, 107.80it/s]
100%|      | 30/30 [00:00<00:00, 107.07it/s]
100%|      | 30/30 [00:00<00:00, 102.19it/s]
100%|      | 30/30 [00:00<00:00, 108.04it/s]
100%|      | 30/30 [00:00<00:00, 105.92it/s]
100%|      | 30/30 [00:00<00:00, 105.66it/s]
100%|      | 30/30 [00:00<00:00, 101.96it/s]
100%|      | 30/30 [00:00<00:00, 101.23it/s]
100%|      | 30/30 [00:00<00:00, 106.90it/s]
100%|      | 30/30 [00:00<00:00, 105.71it/s]
100%|      | 30/30 [00:00<00:00, 104.11it/s]
100%|      | 30/30 [00:00<00:00, 108.45it/s]
100%|      | 30/30 [00:00<00:00, 103.17it/s]
100%|      | 30/30 [00:00<00:00, 100.76it/s]
100%|      | 30/30 [00:00<00:00, 111.13it/s]
100%|      | 30/30 [00:00<00:00, 108.12it/s]
100%|      | 30/30 [00:00<00:00, 90.58it/s]
100%|      | 30/30 [00:00<00:00, 101.09it/s]
100%|      | 30/30 [00:00<00:00, 97.04it/s]
100%|      | 30/30 [00:00<00:00, 99.89it/s]
100%|      | 30/30 [00:00<00:00, 102.86it/s]
100%|      | 30/30 [00:00<00:00, 101.43it/s]
100%|      | 30/30 [00:00<00:00, 109.59it/s]
100%|      | 30/30 [00:00<00:00, 102.05it/s]
100%|      | 30/30 [00:00<00:00, 105.87it/s]
100%|      | 30/30 [00:00<00:00, 103.93it/s]
100%|      | 30/30 [00:00<00:00, 104.06it/s]
100%|      | 30/30 [00:00<00:00, 111.07it/s]
100%|      | 30/30 [00:00<00:00, 107.81it/s]
100%|      | 30/30 [00:00<00:00, 111.92it/s]
100%|      | 30/30 [00:00<00:00, 105.07it/s]
100%|      | 30/30 [00:00<00:00, 108.58it/s]
100%|      | 30/30 [00:00<00:00, 104.84it/s]
100%|      | 30/30 [00:00<00:00, 98.34it/s]
100%|      | 30/30 [00:00<00:00, 102.00it/s]
100%|      | 30/30 [00:00<00:00, 107.98it/s]
100%|      | 30/30 [00:00<00:00, 106.77it/s]
100%|      | 30/30 [00:00<00:00, 105.66it/s]
100%|      | 30/30 [00:00<00:00, 97.01it/s]
100%|      | 30/30 [00:00<00:00, 108.01it/s]
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100%|      | 30/30 [00:00<00:00, 102.46it/s]
100%|      | 30/30 [00:00<00:00, 108.57it/s]
100%|      | 30/30 [00:00<00:00, 106.68it/s]
100%|      | 30/30 [00:00<00:00, 109.28it/s]
100%|      | 30/30 [00:00<00:00, 104.34it/s]
100%|      | 30/30 [00:00<00:00, 102.51it/s]
100%|      | 30/30 [00:00<00:00, 102.27it/s]
100%|      | 30/30 [00:00<00:00, 101.38it/s]
100%|      | 30/30 [00:00<00:00, 103.47it/s]
100%|      | 30/30 [00:00<00:00, 96.66it/s]
100%|      | 30/30 [00:00<00:00, 106.84it/s]
100%|      | 30/30 [00:00<00:00, 101.72it/s]
100%|      | 30/30 [00:00<00:00, 107.30it/s]
100%|      | 30/30 [00:00<00:00, 102.15it/s]
100%|      | 30/30 [00:00<00:00, 91.47it/s]
100%|      | 30/30 [00:00<00:00, 99.39it/s]
100%|      | 30/30 [00:00<00:00, 100.09it/s]
100%|      | 30/30 [00:00<00:00, 96.42it/s]
100%|      | 30/30 [00:00<00:00, 110.66it/s]
100%|      | 30/30 [00:00<00:00, 103.25it/s]
100%|      | 30/30 [00:00<00:00, 105.46it/s]
100%|      | 30/30 [00:00<00:00, 96.35it/s]
100%|      | 30/30 [00:00<00:00, 94.14it/s]
100%|      | 30/30 [00:00<00:00, 101.80it/s]
100%|      | 30/30 [00:00<00:00, 98.67it/s]
100%|      | 30/30 [00:00<00:00, 99.35it/s]
100%|      | 30/30 [00:00<00:00, 92.93it/s]
100%|      | 30/30 [00:00<00:00, 103.63it/s]
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100%|      | 30/30 [00:00<00:00, 106.99it/s]
100%|      | 30/30 [00:00<00:00, 105.92it/s]
100%|      | 30/30 [00:00<00:00, 100.91it/s]
100%|      | 30/30 [00:00<00:00, 98.51it/s]
100%|      | 30/30 [00:00<00:00, 105.85it/s]
100%|      | 30/30 [00:00<00:00, 104.13it/s]
100%|      | 30/30 [00:00<00:00, 106.60it/s]
100%|      | 30/30 [00:00<00:00, 104.15it/s]
100%|      | 30/30 [00:00<00:00, 100.65it/s]
100%|      | 30/30 [00:00<00:00, 103.91it/s]
100%|      | 30/30 [00:00<00:00, 107.45it/s]
100%|      | 30/30 [00:00<00:00, 109.78it/s]
100%|      | 30/30 [00:00<00:00, 102.11it/s]
100%|      | 30/30 [00:00<00:00, 105.53it/s]
100%|      | 30/30 [00:00<00:00, 110.92it/s]
100%|      | 30/30 [00:00<00:00, 97.45it/s]
100%|      | 30/30 [00:00<00:00, 93.94it/s]
100%|      | 30/30 [00:00<00:00, 103.45it/s]
100%|      | 30/30 [00:00<00:00, 104.99it/s]
```

```
100%|      | 30/30 [00:00<00:00, 99.90it/s]
100%|      | 30/30 [00:00<00:00, 101.94it/s]
100%|      | 30/30 [00:00<00:00, 106.09it/s]
100%|      | 30/30 [00:00<00:00, 99.50it/s]
100%|      | 30/30 [00:00<00:00, 93.95it/s]
```

```
Accuracy - spawner: 0.9355555555555556
```

```
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
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```

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100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
```

```
Accuracy - wdba: 0.7822222222222223
```

```
100%|      | 30/30 [00:00<00:00, 110.03it/s]
100%|      | 30/30 [00:00<00:00, 104.30it/s]
100%|      | 30/30 [00:00<00:00, 106.08it/s]
100%|      | 30/30 [00:00<00:00, 108.36it/s]
100%|      | 30/30 [00:00<00:00, 109.65it/s]
100%|      | 30/30 [00:00<00:00, 108.90it/s]
100%|      | 30/30 [00:00<00:00, 93.47it/s]
100%|      | 30/30 [00:00<00:00, 92.68it/s]
100%|      | 30/30 [00:00<00:00, 101.71it/s]
100%|      | 30/30 [00:00<00:00, 101.03it/s]
100%|      | 30/30 [00:00<00:00, 104.32it/s]
100%|      | 30/30 [00:00<00:00, 98.71it/s]
100%|      | 30/30 [00:00<00:00, 92.29it/s]
100%|      | 30/30 [00:00<00:00, 95.10it/s]
100%|      | 30/30 [00:00<00:00, 95.19it/s]
100%|      | 30/30 [00:00<00:00, 95.50it/s]
100%|      | 30/30 [00:00<00:00, 109.23it/s]
100%|      | 30/30 [00:00<00:00, 102.75it/s]
100%|      | 30/30 [00:00<00:00, 109.77it/s]
100%|      | 30/30 [00:00<00:00, 104.90it/s]
100%|      | 30/30 [00:00<00:00, 95.13it/s]
100%|      | 30/30 [00:00<00:00, 92.34it/s]
100%|      | 30/30 [00:00<00:00, 98.36it/s]
100%|      | 30/30 [00:00<00:00, 101.84it/s]
100%|      | 30/30 [00:00<00:00, 104.58it/s]
100%|      | 30/30 [00:00<00:00, 95.15it/s]
100%|      | 30/30 [00:00<00:00, 107.31it/s]
100%|      | 30/30 [00:00<00:00, 107.95it/s]
100%|      | 30/30 [00:00<00:00, 110.13it/s]
100%|      | 30/30 [00:00<00:00, 102.55it/s]
100%|      | 30/30 [00:00<00:00, 99.51it/s]
100%|      | 30/30 [00:00<00:00, 108.32it/s]
100%|      | 30/30 [00:00<00:00, 92.37it/s]
100%|      | 30/30 [00:00<00:00, 110.25it/s]
100%|      | 30/30 [00:00<00:00, 108.79it/s]
100%|      | 30/30 [00:00<00:00, 105.08it/s]
```

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100%|      | 30/30 [00:00<00:00, 94.57it/s]
100%|      | 30/30 [00:00<00:00, 87.62it/s]
100%|      | 30/30 [00:00<00:00, 96.38it/s]
100%|      | 30/30 [00:00<00:00, 101.63it/s]
100%|      | 30/30 [00:00<00:00, 105.54it/s]
100%|      | 30/30 [00:00<00:00, 94.85it/s]
100%|      | 30/30 [00:00<00:00, 97.23it/s]
100%|      | 30/30 [00:00<00:00, 95.54it/s]
100%|      | 30/30 [00:00<00:00, 105.13it/s]
100%|      | 30/30 [00:00<00:00, 98.25it/s]
100%|      | 30/30 [00:00<00:00, 102.31it/s]
100%|      | 30/30 [00:00<00:00, 100.73it/s]
100%|      | 30/30 [00:00<00:00, 109.21it/s]
100%|      | 30/30 [00:00<00:00, 98.83it/s]
100%|      | 30/30 [00:00<00:00, 96.11it/s]
100%|      | 30/30 [00:00<00:00, 98.78it/s]
100%|      | 30/30 [00:00<00:00, 85.64it/s]
100%|      | 30/30 [00:00<00:00, 93.16it/s]
100%|      | 30/30 [00:00<00:00, 95.14it/s]
100%|      | 30/30 [00:00<00:00, 100.76it/s]
100%|      | 30/30 [00:00<00:00, 110.69it/s]
100%|      | 30/30 [00:00<00:00, 107.36it/s]
100%|      | 30/30 [00:00<00:00, 88.40it/s]
100%|      | 30/30 [00:00<00:00, 105.91it/s]
100%|      | 30/30 [00:00<00:00, 101.33it/s]
100%|      | 30/30 [00:00<00:00, 102.80it/s]
100%|      | 30/30 [00:00<00:00, 97.73it/s]
100%|      | 30/30 [00:00<00:00, 105.22it/s]
100%|      | 30/30 [00:00<00:00, 109.32it/s]
100%|      | 30/30 [00:00<00:00, 104.70it/s]
100%|      | 30/30 [00:00<00:00, 107.08it/s]
100%|      | 30/30 [00:00<00:00, 101.32it/s]
100%|      | 30/30 [00:00<00:00, 102.99it/s]
100%|      | 30/30 [00:00<00:00, 101.27it/s]
100%|      | 30/30 [00:00<00:00, 90.77it/s]
100%|      | 30/30 [00:00<00:00, 99.36it/s]
100%|      | 30/30 [00:00<00:00, 95.34it/s]
100%|      | 30/30 [00:00<00:00, 95.19it/s]
100%|      | 30/30 [00:00<00:00, 90.90it/s]
100%|      | 30/30 [00:00<00:00, 97.86it/s]
100%|      | 30/30 [00:00<00:00, 103.18it/s]
100%|      | 30/30 [00:00<00:00, 103.57it/s]
100%|      | 30/30 [00:00<00:00, 101.86it/s]
100%|      | 30/30 [00:00<00:00, 94.72it/s]
100%|      | 30/30 [00:00<00:00, 99.23it/s]
100%|      | 30/30 [00:00<00:00, 103.44it/s]
100%|      | 30/30 [00:00<00:00, 103.17it/s]
100%|      | 30/30 [00:00<00:00, 107.27it/s]
```

```
100%|      | 30/30 [00:00<00:00, 93.68it/s]
100%|      | 30/30 [00:00<00:00, 95.79it/s]
100%|      | 30/30 [00:00<00:00, 107.64it/s]
100%|      | 30/30 [00:00<00:00, 93.51it/s]
100%|      | 30/30 [00:00<00:00, 97.90it/s]
100%|      | 30/30 [00:00<00:00, 93.65it/s]
100%|      | 30/30 [00:00<00:00, 100.30it/s]
100%|      | 30/30 [00:00<00:00, 103.94it/s]
100%|      | 30/30 [00:00<00:00, 93.24it/s]
100%|      | 30/30 [00:00<00:00, 106.09it/s]
100%|      | 30/30 [00:00<00:00, 101.28it/s]
100%|      | 30/30 [00:00<00:00, 101.44it/s]
100%|      | 30/30 [00:00<00:00, 99.95it/s]
100%|      | 30/30 [00:00<00:00, 105.04it/s]
100%|      | 30/30 [00:00<00:00, 99.91it/s]

Accuracy - random_guided_warp: 0.8811111111111111

100%|      | 30/30 [00:03<00:00,  8.55it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.56it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.53it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.56it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.49it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.47it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.47it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.50it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.54it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.56it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.08it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.16it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.47it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]

Accuracy - discriminative_guided_warp: 0.9466666666666667
```

Light GBM

[ ]:
```
lgbm_clf = LGBMClassifier(n_estimators=1000, objective='binary',
                          class_weight={0:25, 1:1}, learning_rate=0.01,
                          boosting_type='dart')
method_apply(lgbm_clf, x_train, y_train, x_test, y_test)
```

```
Accuracy - None: 0.3333333333333333
Accuracy - jitter: 0.7177777777777777
Accuracy - scaling: 0.8066666666666666
Accuracy - rotation: 0.5977777777777777

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Accuracy - permutation: 0.6822222222222222
Accuracy - magnitude_warp: 0.7544444444444445
Accuracy - time_warp: 0.8566666666666667
Accuracy - window_slice: 0.9066666666666666
```

```
Accuracy - window_warp: 0.8522222222222222
```

```
100%|      | 30/30 [00:00<00:00, 94.41it/s]
100%|      | 30/30 [00:00<00:00, 99.69it/s]
100%|      | 30/30 [00:00<00:00, 104.75it/s]
100%|      | 30/30 [00:00<00:00, 102.25it/s]
100%|      | 30/30 [00:00<00:00, 87.58it/s]
100%|      | 30/30 [00:00<00:00, 98.94it/s]
100%|      | 30/30 [00:00<00:00, 106.25it/s]
100%|      | 30/30 [00:00<00:00, 92.33it/s]
100%|      | 30/30 [00:00<00:00, 109.59it/s]
100%|      | 30/30 [00:00<00:00, 109.48it/s]
100%|      | 30/30 [00:00<00:00, 99.40it/s]
100%|      | 30/30 [00:00<00:00, 106.77it/s]
100%|      | 30/30 [00:00<00:00, 101.81it/s]
100%|      | 30/30 [00:00<00:00, 103.42it/s]
100%|      | 30/30 [00:00<00:00, 99.37it/s]
100%|      | 30/30 [00:00<00:00, 97.39it/s]
100%|      | 30/30 [00:00<00:00, 101.26it/s]
100%|      | 30/30 [00:00<00:00, 108.44it/s]
100%|      | 30/30 [00:00<00:00, 87.99it/s]
100%|      | 30/30 [00:00<00:00, 102.45it/s]
100%|      | 30/30 [00:00<00:00, 111.53it/s]
100%|      | 30/30 [00:00<00:00, 98.02it/s]
100%|      | 30/30 [00:00<00:00, 107.25it/s]
100%|      | 30/30 [00:00<00:00, 107.74it/s]
100%|      | 30/30 [00:00<00:00, 97.30it/s]
100%|      | 30/30 [00:00<00:00, 107.80it/s]
100%|      | 30/30 [00:00<00:00, 107.38it/s]
100%|      | 30/30 [00:00<00:00, 108.10it/s]
100%|      | 30/30 [00:00<00:00, 100.35it/s]
100%|      | 30/30 [00:00<00:00, 100.44it/s]
100%|      | 30/30 [00:00<00:00, 111.63it/s]
100%|      | 30/30 [00:00<00:00, 106.55it/s]
100%|      | 30/30 [00:00<00:00, 109.05it/s]
100%|      | 30/30 [00:00<00:00, 106.78it/s]
100%|      | 30/30 [00:00<00:00, 105.96it/s]
100%|      | 30/30 [00:00<00:00, 105.64it/s]
100%|      | 30/30 [00:00<00:00, 100.74it/s]
100%|      | 30/30 [00:00<00:00, 110.44it/s]
100%|      | 30/30 [00:00<00:00, 103.82it/s]
100%|      | 30/30 [00:00<00:00, 101.68it/s]
100%|      | 30/30 [00:00<00:00, 96.66it/s]
100%|      | 30/30 [00:00<00:00, 99.89it/s]
100%|      | 30/30 [00:00<00:00, 99.25it/s]
100%|      | 30/30 [00:00<00:00, 104.06it/s]
100%|      | 30/30 [00:00<00:00, 107.00it/s]
100%|      | 30/30 [00:00<00:00, 94.70it/s]
```

```
100%|      | 30/30 [00:00<00:00, 104.97it/s]
100%|      | 30/30 [00:00<00:00, 96.59it/s]
100%|      | 30/30 [00:00<00:00, 100.32it/s]
100%|      | 30/30 [00:00<00:00, 110.75it/s]
100%|      | 30/30 [00:00<00:00, 102.07it/s]
100%|      | 30/30 [00:00<00:00, 109.00it/s]
100%|      | 30/30 [00:00<00:00, 100.30it/s]
100%|      | 30/30 [00:00<00:00, 104.77it/s]
100%|      | 30/30 [00:00<00:00, 104.85it/s]
100%|      | 30/30 [00:00<00:00, 97.15it/s]
100%|      | 30/30 [00:00<00:00, 102.30it/s]
100%|      | 30/30 [00:00<00:00, 102.95it/s]
100%|      | 30/30 [00:00<00:00, 99.92it/s]
100%|      | 30/30 [00:00<00:00, 107.59it/s]
100%|      | 30/30 [00:00<00:00, 104.54it/s]
100%|      | 30/30 [00:00<00:00, 100.34it/s]
100%|      | 30/30 [00:00<00:00, 103.03it/s]
100%|      | 30/30 [00:00<00:00, 105.82it/s]
100%|      | 30/30 [00:00<00:00, 103.90it/s]
100%|      | 30/30 [00:00<00:00, 97.35it/s]
100%|      | 30/30 [00:00<00:00, 96.99it/s]
100%|      | 30/30 [00:00<00:00, 104.94it/s]
100%|      | 30/30 [00:00<00:00, 109.30it/s]
100%|      | 30/30 [00:00<00:00, 100.58it/s]
100%|      | 30/30 [00:00<00:00, 102.83it/s]
100%|      | 30/30 [00:00<00:00, 102.76it/s]
100%|      | 30/30 [00:00<00:00, 107.16it/s]
100%|      | 30/30 [00:00<00:00, 108.36it/s]
100%|      | 30/30 [00:00<00:00, 104.62it/s]
100%|      | 30/30 [00:00<00:00, 105.86it/s]
100%|      | 30/30 [00:00<00:00, 100.25it/s]
100%|      | 30/30 [00:00<00:00, 104.65it/s]
100%|      | 30/30 [00:00<00:00, 100.74it/s]
100%|      | 30/30 [00:00<00:00, 95.43it/s]
100%|      | 30/30 [00:00<00:00, 99.91it/s]
100%|      | 30/30 [00:00<00:00, 97.36it/s]
100%|      | 30/30 [00:00<00:00, 91.43it/s]
100%|      | 30/30 [00:00<00:00, 103.12it/s]
100%|      | 30/30 [00:00<00:00, 93.75it/s]
100%|      | 30/30 [00:00<00:00, 91.29it/s]
100%|      | 30/30 [00:00<00:00, 92.07it/s]
100%|      | 30/30 [00:00<00:00, 110.46it/s]
100%|      | 30/30 [00:00<00:00, 93.46it/s]
100%|      | 30/30 [00:00<00:00, 87.86it/s]
100%|      | 30/30 [00:00<00:00, 96.45it/s]
100%|      | 30/30 [00:00<00:00, 103.81it/s]
100%|      | 30/30 [00:00<00:00, 99.04it/s]
100%|      | 30/30 [00:00<00:00, 101.21it/s]
```

```
100%|      | 30/30 [00:00<00:00, 98.57it/s]
100%|      | 30/30 [00:00<00:00, 98.50it/s]
100%|      | 30/30 [00:00<00:00, 105.60it/s]
100%|      | 30/30 [00:00<00:00, 109.01it/s]
100%|      | 30/30 [00:00<00:00, 104.03it/s]
```

```
Accuracy - spawner: 0.9144444444444444
```

```
100%|      | 30/30 [00:07<00:00,  3.99it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:09<00:00,  3.28it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  4.00it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.99it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
```

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100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
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100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.98it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.96it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.97it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.95it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
```

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100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:07<00:00,  3.94it/s]
100%|      | 30/30 [00:08<00:00,  3.73it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
```

```
Accuracy - wdba: 0.7444444444444445
```

```
100%|      | 30/30 [00:00<00:00, 95.61it/s]
100%|      | 30/30 [00:00<00:00, 93.74it/s]
100%|      | 30/30 [00:00<00:00, 100.06it/s]
100%|      | 30/30 [00:00<00:00, 105.29it/s]
100%|      | 30/30 [00:00<00:00, 100.48it/s]
100%|      | 30/30 [00:00<00:00, 99.73it/s]
100%|      | 30/30 [00:00<00:00, 109.35it/s]
100%|      | 30/30 [00:00<00:00, 106.28it/s]
100%|      | 30/30 [00:00<00:00, 93.94it/s]
100%|      | 30/30 [00:00<00:00, 89.95it/s]
100%|      | 30/30 [00:00<00:00, 95.69it/s]
100%|      | 30/30 [00:00<00:00, 96.06it/s]
100%|      | 30/30 [00:00<00:00, 96.60it/s]
100%|      | 30/30 [00:00<00:00, 91.32it/s]
100%|      | 30/30 [00:00<00:00, 103.01it/s]
100%|      | 30/30 [00:00<00:00, 98.76it/s]
100%|      | 30/30 [00:00<00:00, 103.41it/s]
100%|      | 30/30 [00:00<00:00, 100.89it/s]
100%|      | 30/30 [00:00<00:00, 97.59it/s]
100%|      | 30/30 [00:00<00:00, 106.54it/s]
100%|      | 30/30 [00:00<00:00, 104.27it/s]
100%|      | 30/30 [00:00<00:00, 96.91it/s]
100%|      | 30/30 [00:00<00:00, 106.45it/s]
100%|      | 30/30 [00:00<00:00, 100.65it/s]
100%|      | 30/30 [00:00<00:00, 94.79it/s]
100%|      | 30/30 [00:00<00:00, 95.00it/s]
100%|      | 30/30 [00:00<00:00, 109.38it/s]
100%|      | 30/30 [00:00<00:00, 110.70it/s]
100%|      | 30/30 [00:00<00:00, 104.09it/s]
100%|      | 30/30 [00:00<00:00, 104.90it/s]
100%|      | 30/30 [00:00<00:00, 99.60it/s]
100%|      | 30/30 [00:00<00:00, 99.72it/s]
100%|      | 30/30 [00:00<00:00, 104.79it/s]
100%|      | 30/30 [00:00<00:00, 101.34it/s]
100%|      | 30/30 [00:00<00:00, 100.49it/s]
100%|      | 30/30 [00:00<00:00, 108.86it/s]
```

```
100%|      | 30/30 [00:00<00:00, 106.70it/s]
100%|      | 30/30 [00:00<00:00, 104.50it/s]
100%|      | 30/30 [00:00<00:00, 90.72it/s]
100%|      | 30/30 [00:00<00:00, 105.74it/s]
100%|      | 30/30 [00:00<00:00, 107.24it/s]
100%|      | 30/30 [00:00<00:00, 104.30it/s]
100%|      | 30/30 [00:00<00:00, 104.48it/s]
100%|      | 30/30 [00:00<00:00, 93.77it/s]
100%|      | 30/30 [00:00<00:00, 98.08it/s]
100%|      | 30/30 [00:00<00:00, 104.37it/s]
100%|      | 30/30 [00:00<00:00, 100.21it/s]
100%|      | 30/30 [00:00<00:00, 97.04it/s]
100%|      | 30/30 [00:00<00:00, 98.48it/s]
100%|      | 30/30 [00:00<00:00, 109.26it/s]
100%|      | 30/30 [00:00<00:00, 105.59it/s]
100%|      | 30/30 [00:00<00:00, 99.84it/s]
100%|      | 30/30 [00:00<00:00, 103.61it/s]
100%|      | 30/30 [00:00<00:00, 105.41it/s]
100%|      | 30/30 [00:00<00:00, 102.28it/s]
100%|      | 30/30 [00:00<00:00, 87.79it/s]
100%|      | 30/30 [00:00<00:00, 90.42it/s]
100%|      | 30/30 [00:00<00:00, 103.73it/s]
100%|      | 30/30 [00:00<00:00, 100.19it/s]
100%|      | 30/30 [00:00<00:00, 106.15it/s]
100%|      | 30/30 [00:00<00:00, 95.78it/s]
100%|      | 30/30 [00:00<00:00, 97.07it/s]
100%|      | 30/30 [00:00<00:00, 97.83it/s]
100%|      | 30/30 [00:00<00:00, 108.04it/s]
100%|      | 30/30 [00:00<00:00, 101.53it/s]
100%|      | 30/30 [00:00<00:00, 99.30it/s]
100%|      | 30/30 [00:00<00:00, 97.61it/s]
100%|      | 30/30 [00:00<00:00, 99.30it/s]
100%|      | 30/30 [00:00<00:00, 93.34it/s]
100%|      | 30/30 [00:00<00:00, 98.67it/s]
100%|      | 30/30 [00:00<00:00, 109.81it/s]
100%|      | 30/30 [00:00<00:00, 94.97it/s]
100%|      | 30/30 [00:00<00:00, 109.50it/s]
100%|      | 30/30 [00:00<00:00, 86.20it/s]
100%|      | 30/30 [00:00<00:00, 102.71it/s]
100%|      | 30/30 [00:00<00:00, 107.97it/s]
100%|      | 30/30 [00:00<00:00, 89.98it/s]
100%|      | 30/30 [00:00<00:00, 102.39it/s]
100%|      | 30/30 [00:00<00:00, 100.06it/s]
100%|      | 30/30 [00:00<00:00, 106.95it/s]
100%|      | 30/30 [00:00<00:00, 108.69it/s]
100%|      | 30/30 [00:00<00:00, 103.44it/s]
100%|      | 30/30 [00:00<00:00, 108.43it/s]
100%|      | 30/30 [00:00<00:00, 100.20it/s]
```

```
100%|      | 30/30 [00:00<00:00, 85.93it/s]
100%|      | 30/30 [00:00<00:00, 95.77it/s]
100%|      | 30/30 [00:00<00:00, 107.85it/s]
100%|      | 30/30 [00:00<00:00, 106.92it/s]
100%|      | 30/30 [00:00<00:00, 105.60it/s]
100%|      | 30/30 [00:00<00:00, 99.95it/s]
100%|      | 30/30 [00:00<00:00, 103.66it/s]
100%|      | 30/30 [00:00<00:00, 88.12it/s]
100%|      | 30/30 [00:00<00:00, 97.02it/s]
100%|      | 30/30 [00:00<00:00, 97.71it/s]
100%|      | 30/30 [00:00<00:00, 96.27it/s]
100%|      | 30/30 [00:00<00:00, 100.00it/s]
100%|      | 30/30 [00:00<00:00, 93.27it/s]
100%|      | 30/30 [00:00<00:00, 91.42it/s]
100%|      | 30/30 [00:00<00:00, 108.56it/s]

Accuracy - random_guided_warp: 0.8844444444444445

100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.50it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.49it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.51it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.52it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.53it/s]
100%|      | 30/30 [00:03<00:00,  8.55it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.50it/s]
100%|      | 30/30 [00:03<00:00,  8.45it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.50it/s]
100%|      | 30/30 [00:03<00:00,  8.53it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.54it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.49it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.46it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.50it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.56it/s]
100%|      | 30/30 [00:03<00:00,  8.53it/s]
100%|      | 30/30 [00:03<00:00,  8.47it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.48it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.47it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.48it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.48it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.52it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.16it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]

Accuracy - discriminative_guided_warp: 0.9177777777777778
```

6 Các mô hình Deep Learning cơ bản

6.0.1 Thiết kế mô hình Học sâu

[ ]:
```
from tensorflow.keras.models import Model
from tensorflow.keras.layers import Dense, Flatten, Dropout, Input
from tensorflow.keras.layers import MaxPooling1D, Conv1D
from tensorflow.keras.layers import LSTM, Bidirectional
from tensorflow.keras.layers import BatchNormalization, GlobalAveragePooling1D,␣
 ↪Permute, concatenate, Activation, add
import numpy as np
import math

def get_model(model_name, input_shape, nb_class):
    if model_name == "vgg":
        model = cnn_vgg(input_shape, nb_class)
    elif model_name == "lstm1":
        model = lstm1(input_shape, nb_class)
    elif model_name == "lstm":
        model = lstm1v0(input_shape, nb_class)
    elif model_name == "lstm2":
        model = lstm2(input_shape, nb_class)
    elif model_name == "blstm1":
        model = blstm1(input_shape, nb_class)
    elif model_name == "blstm2":
```

```
        model = blstm2(input_shape, nb_class)
    elif model_name == "lstmfcn":
        model = lstm_fcn(input_shape, nb_class)
    elif model_name == "resnet":
        model = cnn_resnet(input_shape, nb_class)
    elif model_name == "mlp":
        model = mlp4(input_shape, nb_class)
    elif model_name == "lenet":
        model = cnn_lenet(input_shape, nb_class)
    else:
        print("model name missing")
    return model


def mlp4(input_shape, nb_class):
    # Z. Wang, W. Yan, T. Oates, "Time Series Classification from Scratch with␣
 ↪Deep Neural Networks: A Strong Baseline," Int. Joint Conf. Neural Networks,␣
 ↪2017, pp. 1578-1585

    ip = Input(shape=input_shape)
    fc = Flatten()(ip)

    fc = Dropout(0.1)(fc)

    fc = Dense(500, activation='relu')(fc)
    fc = Dropout(0.2)(fc)

    fc = Dense(500, activation='relu')(fc)
    fc = Dropout(0.2)(fc)

    fc = Dense(500, activation='relu')(fc)
    fc = Dropout(0.3)(fc)

    out = Dense(nb_class, activation='softmax')(fc)

    model = Model([ip], [out])
    model.summary()
    return model

def cnn_lenet(input_shape, nb_class):
    # Y. Lecun, L. Bottou, Y. Bengio, and P. Haffner, "Gradient-based learning␣
 ↪applied to document recognition," Proceedings of the IEEE, vol. 86, no. 11,␣
 ↪pp. 2278-2324, 1998.

    ip = Input(shape=input_shape)

    conv = ip
```

```
    nb_cnn = int(round(math.log(input_shape[0], 2))-3)
    print("pooling layers: %d"%nb_cnn)

    for i in range(nb_cnn):
        conv = Conv1D(6+10*i, 3, padding='same', activation="relu",␣
↪kernel_initializer='he_uniform')(conv)
        conv = MaxPooling1D(pool_size=2)(conv)

    flat = Flatten()(conv)

    fc = Dense(120, activation='relu')(flat)
    fc = Dropout(0.5)(fc)

    fc = Dense(84, activation='relu')(fc)
    fc = Dropout(0.5)(fc)

    out = Dense(nb_class, activation='softmax')(fc)

    model = Model([ip], [out])
    model.summary()
    return model


def cnn_vgg(input_shape, nb_class):
    # K. Simonyan and A. Zisserman, "Very deep convolutional networks for␣
↪large-scale image recognition," arXiv preprint arXiv:1409.1556, 2014.

    ip = Input(shape=input_shape)

    conv = ip

    nb_cnn = int(round(math.log(input_shape[0], 2))-3)
    print("pooling layers: %d"%nb_cnn)

    for i in range(nb_cnn):
        num_filters = min(64*2**i, 512)
        conv = Conv1D(num_filters, 3, padding='same', activation="relu",␣
↪kernel_initializer='he_uniform')(conv)
        conv = Conv1D(num_filters, 3, padding='same', activation="relu",␣
↪kernel_initializer='he_uniform')(conv)
        if i > 1:
            conv = Conv1D(num_filters, 3, padding='same', activation="relu",␣
↪kernel_initializer='he_uniform')(conv)
        conv = MaxPooling1D(pool_size=2)(conv)

    flat = Flatten()(conv)
```

```
    fc = Dense(4096, activation='relu')(flat)
    fc = Dropout(0.5)(fc)

    fc = Dense(4096, activation='relu')(fc)
    fc = Dropout(0.5)(fc)

    out = Dense(nb_class, activation='softmax')(fc)

    model = Model([ip], [out])
    model.summary()
    return model

def lstm1v0(input_shape, nb_class):
    # Original proposal:
    # S. Hochreiter and J. Schmidhuber, "Long Short-Term Memory," Neural␣
 ↪Computation, vol. 9, no. 8, pp. 1735-1780, Nov. 1997.

    ip = Input(shape=input_shape)

    l2 = LSTM(512)(ip)
    out = Dense(nb_class, activation='softmax')(l2)

    model = Model([ip], [out])

    model.summary()

    return model

def lstm1(input_shape, nb_class):
    # Original proposal:
    # S. Hochreiter and J. Schmidhuber, "Long Short-Term Memory," Neural␣
 ↪Computation, vol. 9, no. 8, pp. 1735-1780, Nov. 1997.

    # Hyperparameter choices:
    # N. Reimers and I. Gurevych, "Optimal hyperparameters for deep␣
 ↪lstm-networks for sequence labeling tasks," arXiv, preprint arXiv:1707.
 ↪06799, 2017

    ip = Input(shape=input_shape)

    l2 = LSTM(100)(ip)
    out = Dense(nb_class, activation='softmax')(l2)

    model = Model([ip], [out])

    model.summary()
```

```
    return model


def lstm2(input_shape, nb_class):
    ip = Input(shape=input_shape)

    l1 = LSTM(100, return_sequences=True)(ip)
    l2 = LSTM(100)(l1)
    out = Dense(nb_class, activation='softmax')(l2)

    model = Model([ip], [out])

    model.summary()

    return model


def blstm1(input_shape, nb_class):
    # Original proposal:
    # M. Schuster and K. K. Paliwal, "Bidirectional recurrent neural networks,"␣
 ↪IEEE Transactions on Signal Processing, vol. 45, no. 11, pp. 2673-2681, 1997.

    # Hyperparameter choices:
    # N. Reimers and I. Gurevych, "Optimal hyperparameters for deep␣
 ↪lstm-networks for sequence labeling tasks," arXiv, preprint arXiv:1707.
 ↪06799, 2017
    ip = Input(shape=input_shape)

    l2 = Bidirectional(LSTM(100))(ip)
    out = Dense(nb_class, activation='softmax')(l2)

    model = Model([ip], [out])

    model.summary()

    return model

def blstm2(input_shape, nb_class):
    ip = Input(shape=input_shape)

    l1 = Bidirectional(LSTM(100, return_sequences=True))(ip)
    l2 = Bidirectional(LSTM(100))(l1)
    out = Dense(nb_class, activation='softmax')(l2)

    model = Model([ip], [out])
```

```
    model.summary()

    return model

def lstm_fcn(input_shape, nb_class):
    # F. Karim, S. Majumdar, H. Darabi, and S. Chen, "LSTM Fully Convolutional␣
 ↪Networks for Time Series Classification," IEEE Access, vol. 6, pp. 1662-
1669, 2018.

    ip = Input(shape=input_shape)

    # lstm part is a 1 time step multivariate as described in Karim et al.␣
 ↪Seems strange, but works I guess.
    lstm = Permute((2, 1))(ip)

    lstm = LSTM(128)(lstm)
    lstm = Dropout(0.8)(lstm)

    conv = Conv1D(128, 8, padding='same', kernel_initializer='he_uniform')(ip)
    conv = BatchNormalization()(conv)
    conv = Activation('relu')(conv)

    conv = Conv1D(256, 5, padding='same', kernel_initializer='he_uniform')(conv)
    conv = BatchNormalization()(conv)
    conv = Activation('relu')(conv)

    conv = Conv1D(128, 3, padding='same', kernel_initializer='he_uniform')(conv)
    conv = BatchNormalization()(conv)
    conv = Activation('relu')(conv)

    flat = GlobalAveragePooling1D()(conv)

    flat = concatenate([lstm, flat])

    out = Dense(nb_class, activation='softmax')(flat)

    model = Model([ip], [out])

    model.summary()

    return model


def cnn_resnet(input_shape, nb_class):
```

```
    # I. Fawaz, G. Forestier, J. Weber, L. Idoumghar, P-A Muller, "Data␣
↪augmentation using synthetic data for time series classification with deep␣
↪residual networks," International Workshop on Advanced Analytics and␣
↪Learning on Temporal Data ECML/PKDD, 2018

    ip = Input(shape=input_shape)
    residual = ip
    conv = ip

    for i, nb_nodes in enumerate([64, 128, 128]):
        conv = Conv1D(nb_nodes, 8, padding='same',␣
↪kernel_initializer="glorot_uniform")(conv)
        conv = BatchNormalization()(conv)
        conv = Activation('relu')(conv)

        conv = Conv1D(nb_nodes, 5, padding='same',␣
↪kernel_initializer="glorot_uniform")(conv)
        conv = BatchNormalization()(conv)
        conv = Activation('relu')(conv)

        conv = Conv1D(nb_nodes, 3, padding='same',␣
↪kernel_initializer="glorot_uniform")(conv)
        conv = BatchNormalization()(conv)
        conv = Activation('relu')(conv)

        if i < 2:
            # expands dimensions according to Fawaz et al.
            residual = Conv1D(nb_nodes, 1, padding='same',␣
↪kernel_initializer="glorot_uniform")(residual)
        residual = BatchNormalization()(residual)
        conv = add([residual, conv])
        conv = Activation('relu')(conv)

        residual = conv

    flat = GlobalAveragePooling1D()(conv)

    out = Dense(nb_class, activation='softmax')(flat)

    model = Model([ip], [out])

    model.summary()

    return model
```

6.0.2 Chuẩn hóa dữ liệu đầu vào

[ ]:
```
def nb_dims(dataset):
    if dataset in ["unipen1a", "unipen1b", "unipen1c"]:
        return 2
    return 1

def nb_classes(dataset):
    if dataset == "CBF":
        return 3 #128

def class_offset(y, dataset):
    return (y + class_modifier_add(dataset)) * class_modifier_multi(dataset)

def class_modifier_add(dataset):
    if dataset == "CBF":
        return -1 #128
    return 0

def class_modifier_multi(dataset):
    if dataset == "ECG200":
        return 0.5 #96
    if dataset == "FordA":
        return 0.5 #500
    if dataset == "FordB":
        return 0.5 # 500
    if dataset == "Lightning2":
        return 0.5 # 637
    if dataset == "Wafer":
        return 0.5 #152
    return 1
```

[ ]:
```
nb_class = 3
nb_dims = 1
input_shape = (128, 1)
```

[ ]:
```
x_test = x_test.reshape((-1, input_shape[0], input_shape[1]))
x_train = x_train.reshape((-1, input_shape[0], input_shape[1]))
y_test = to_categorical(class_offset(y_test, "CBF"), nb_class)
y_train = to_categorical(class_offset(y_train, "CBF"), nb_class)
y_train_new = to_categorical(class_offset(y_train_new, "CBF"), nb_class)
```

6.1 Hàm áp dụng dữ liệu sinh từ 12 Phương pháp lần lượt vào mô hình HỌC SÂU

[ ]:
```
def method_apply_deep(model, x_train, y_train, x_test, y_test):

  # Khong ap dung Sinh du lieu
  model.fit(x_train, y_train, batch_size=batch_size, epochs=nb_epochs)
  yloss, accuracy_None = model.evaluate(x_test, y_test, batch_size=batch_size)

  # Ap dung PP jitter
  x_train_jitter = x_train
  for i in range(0, 99):
    tmp1 = augmentation.jitter(x_train)
    x_train_jitter = np.append(x_train_jitter, tmp1, axis = 0)
  model.fit(x_train_jitter.reshape(3000,128), y_train_new,␣
↪batch_size=batch_size, epochs=nb_epochs)
  yloss, accuracy_jitter = model.evaluate(x_test, y_test, batch_size=batch_size)

# Ap dung PP scaling
  x_train_scaling = x_train
  for i in range(0, 99):
    tmp1 = augmentation.scaling(x_train)
    x_train_scaling = np.append(x_train_scaling, tmp1, axis = 0)
  model.fit(x_train_scaling.reshape(3000,128), y_train_new,␣
↪batch_size=batch_size, epochs=nb_epochs)
  yloss, accuracy_scaling = model.evaluate(x_test, y_test,␣
↪batch_size=batch_size)

  # Ap dung PP rotation
  x_train_rotation = x_train
  for i in range(0, 99):
    tmp1 = augmentation.rotation(x_train)
    x_train_rotation = np.append(x_train_rotation, tmp1, axis = 0)
  model.fit(x_train_rotation.reshape(3000,128), y_train_new,␣
↪batch_size=batch_size, epochs=nb_epochs)
  yloss, accuracy_rotation = model.evaluate(x_test, y_test,␣
↪batch_size=batch_size)

  #Ap dung PP permutation
  x_train_permutation = x_train
  for i in range(0, 99):
    tmp1 = augmentation.permutation(x_train)
    x_train_permutation = np.append(x_train_permutation, tmp1, axis = 0)
  model.fit(x_train_permutation.reshape(3000,128), y_train_new,␣
↪batch_size=batch_size, epochs=nb_epochs)
  yloss, accuracy_permutation = model.evaluate(x_test, y_test,␣
↪batch_size=batch_size)
```

```
 # Áp dụng PP magnitude_warp
 x_train_magnitude_warp = x_train
 for i in range(0, 99):
   tmp1 = augmentation.magnitude_warp(x_train)
   x_train_magnitude_warp = np.append(x_train_magnitude_warp, tmp1, axis = 0)
 model.fit(x_train_magnitude_warp.reshape(3000,128), y_train_new,␣
↪batch_size=batch_size, epochs=nb_epochs)
 yloss, accuracy_magnitude_warp = model.evaluate(x_test, y_test,␣
↪batch_size=batch_size)

 # Áp dụng PP time_warp
 x_train_time_warp = x_train
 for i in range(0, 99):
   tmp1 = augmentation.time_warp(x_train)
   x_train_time_warp = np.append(x_train_time_warp, tmp1, axis = 0)
 model.fit(x_train_jitter.reshape(3000,128), y_train_new,␣
↪batch_size=batch_size, epochs=nb_epochs)
 yloss, accuracy_time_warp = model.evaluate(x_test, y_test,␣
↪batch_size=batch_size)

 # Áp dụng PP window_slice
 x_train_window_slice = x_train
 for i in range(0, 99):
   tmp1 = augmentation.window_slice(x_train)
   x_train_window_slice = np.append(x_train_window_slice, tmp1, axis = 0)
 model.fit(x_train_window_slice.reshape(3000,128), y_train_new,␣
↪batch_size=batch_size, epochs=nb_epochs)
 yloss, accuracy_window_slice = model.evaluate(x_test, y_test,␣
↪batch_size=batch_size)

 # Áp dụng PP window_warp
 x_train_window_warp = x_train
 for i in range(0, 99):
   tmp1 = augmentation.window_warp(x_train)
   x_train_window_warp = np.append(x_train_window_warp, tmp1, axis = 0)
 model.fit(x_train_window_warp.reshape(3000,128), y_train_new,␣
↪batch_size=batch_size, epochs=nb_epochs)
 yloss, accuracy_window_warp = model.evaluate(x_test, y_test,␣
↪batch_size=batch_size)

 # Áp dụng PP spawner
 x_train_spawner = x_train
 for i in range(0, 99):
   tmp1 = spawner(x_train, y_train)
   x_train_spawner = np.append(x_train_spawner, tmp1, axis = 0)
```

```
 model.fit(x_train_spawner.reshape(3000,128), y_train_new,␣
↪batch_size=batch_size, epochs=nb_epochs)
 yloss, accuracy_spawner = model.evaluate(x_test, y_test,␣
↪batch_size=batch_size)

 # Ap dung PP wdba
 x_train_wdba = x_train
 for i in range(0, 99):
   tmp1 = wdba(x_train, y_train)
   x_train_wdba = np.append(x_train_wdba, tmp1, axis = 0)
 model.fit(x_train_wdba.reshape(3000,128), y_train_new, batch_size=batch_size,␣
↪epochs=nb_epochs)
 yloss, accuracy_wdba = model.evaluate(x_test, y_test, batch_size=batch_size)

 # Ap dung PP random_guided_warp
 x_train_random_guided_warp = x_train
 for i in range(0, 99):
   tmp1 = random_guided_warp(x_train, y_train)
   x_train_random_guided_warp = np.append(x_train_random_guided_warp, tmp1,␣
↪axis = 0)
 model.fit(x_train_random_guided_warp.reshape(3000,128), y_train_new,␣
↪batch_size=batch_size, epochs=nb_epochs)
 yloss, accuracy_random_guided_warp = model.evaluate(x_test, y_test,␣
↪batch_size=batch_size)

 # Ap dung PP discriminative_guided_warp
 x_train_discriminative_guided_warp = x_train
 for i in range(0, 99):
   tmp1 = discriminative_guided_warp(x_train, y_train)
   x_train_discriminative_guided_warp = np.
↪append(x_train_discriminative_guided_warp, tmp1, axis = 0)
 model.fit(x_train_discriminative_guided_warp.reshape(3000,128), y_train_new,␣
↪batch_size=batch_size, epochs=nb_epochs)
 yloss, accuracy_discriminative_guided_warp = model.evaluate(x_test, y_test,␣
↪batch_size=batch_size)

 print("Accuracy - None:: ", accuracy_None)
 print("Accuracy - jitter:: ", accuracy_jitter)
 print("Accuracy - scaling:: ", accuracy_scaling)
 print("Accuracy - rotation:: ", accuracy_rotation)
 print("Accuracy - permutation:: ", accuracy_permutation)
 print("Accuracy - magnitude_warp:: ", accuracy_magnitude_warp)
 print("Accuracy - time_warp:: ", accuracy_time_warp)
 print("Accuracy - window_slice:: ", accuracy_window_slice)
 print("Accuracy - window_warp:: ", accuracy_window_warp)
 print("Accuracy - spawner:: ", accuracy_spawner)
```

```
  print("Accuracy - wdba:: ", accuracy_wdba)
  print("Accuracy - random_guided_warp:: ", accuracy_random_guided_warp)
  print("Accuracy - discriminative_guided_warp:: ",␣
↪accuracy_discriminative_guided_warp)
```

Thiết lập thông số mô hình

[ ]:
```
nb_iterations = 1000
batch_size = 256
# nb_epochs = np.ceil(nb_iterations * (batch_size / x_train.shape[0])).
↪astype(int)
nb_epochs = 5
lr =1e-2
```

[ ]:
```
reduce_lr = ReduceLROnPlateau(monitor='acc', factor=0.1, patience=np.
↪ceil(nb_epochs/20.).astype(int), verbose=0, mode='auto', min_lr=1e-5,␣
↪cooldown=np.ceil(nb_epochs/40.).astype(int))
```

[ ]:
```
optimizer = "sgd"
if optimizer=="adam":
        from tensorflow.keras.optimizers import Adam
        optm = Adam(lr=lr)
elif optimizer=="nadam":
    from tensorflow.keras.optimizers import Nadam
    optm = Nadam(lr=lr)
elif optimizer=="adadelta":
    from tensorflow.keras.optimizers import Adadelta
    optm = Adadelta(lr=lr, rho=0.95, epsilon=1e-8)
else:
    from tensorflow.keras.optimizers import SGD
    optm = SGD(lr=lr, decay=5e-4, momentum=0.9) #, nesterov=True)
```

```
/usr/local/lib/python3.7/dist-
packages/keras/optimizer_v2/gradient_descent.py:102: UserWarning: The `lr`
argument is deprecated, use `learning_rate` instead.
  super(SGD, self).__init__(name, **kwargs)
```

vgg

[ ]:
```
model = get_model("vgg", input_shape, nb_class)
model.compile(optimizer=optm, loss='categorical_crossentropy',␣
↪metrics=['accuracy'])
method_apply_deep(model, x_train, y_train, x_test, y_test)
```

```
pooling layers: 4
Model: "model"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
```

```
=================================================================
 input_1 (InputLayer)        [(None, 128, 1)]          0

 conv1d (Conv1D)             (None, 128, 64)           256

 conv1d_1 (Conv1D)           (None, 128, 64)           12352

 max_pooling1d (MaxPooling1D  (None, 64, 64)           0
 )

 conv1d_2 (Conv1D)           (None, 64, 128)           24704

 conv1d_3 (Conv1D)           (None, 64, 128)           49280

 max_pooling1d_1 (MaxPooling  (None, 32, 128)          0
 1D)

 conv1d_4 (Conv1D)           (None, 32, 256)           98560

 conv1d_5 (Conv1D)           (None, 32, 256)           196864

 conv1d_6 (Conv1D)           (None, 32, 256)           196864

 max_pooling1d_2 (MaxPooling  (None, 16, 256)          0
 1D)

 conv1d_7 (Conv1D)           (None, 16, 512)           393728

 conv1d_8 (Conv1D)           (None, 16, 512)           786944

 conv1d_9 (Conv1D)           (None, 16, 512)           786944

 max_pooling1d_3 (MaxPooling  (None, 8, 512)           0
 1D)

 flatten (Flatten)           (None, 4096)              0

 dense (Dense)               (None, 4096)              16781312

 dropout (Dropout)           (None, 4096)              0

 dense_1 (Dense)             (None, 4096)              16781312

 dropout_1 (Dropout)         (None, 4096)              0

 dense_2 (Dense)             (None, 3)                 12291

=================================================================
```

```
Total params: 36,121,411
Trainable params: 36,121,411
Non-trainable params: 0
_________________________________________________________________
Epoch 1/5
1/1 [==============================] - 2s 2s/step - loss: 1.4101 - accuracy:
0.4000
Epoch 2/5
1/1 [==============================] - 1s 730ms/step - loss: 1.0872 - accuracy:
0.4000
Epoch 3/5
1/1 [==============================] - 1s 710ms/step - loss: 1.1744 - accuracy:
0.4000
Epoch 4/5
1/1 [==============================] - 1s 712ms/step - loss: 0.9760 - accuracy:
0.6333
Epoch 5/5
1/1 [==============================] - 1s 718ms/step - loss: 0.7186 - accuracy:
0.7667
4/4 [==============================] - 3s 610ms/step - loss: 0.8712 - accuracy:
0.4133
Epoch 1/5
12/12 [==============================] - 48s 4s/step - loss: 0.2774 - accuracy:
0.8807
Epoch 2/5
12/12 [==============================] - 47s 4s/step - loss: 0.0129 - accuracy:
0.9940
Epoch 3/5
12/12 [==============================] - 47s 4s/step - loss: 0.0025 - accuracy:
0.9997
Epoch 4/5
12/12 [==============================] - 47s 4s/step - loss: 4.4732e-04 -
accuracy: 1.0000
Epoch 5/5
12/12 [==============================] - 47s 4s/step - loss: 6.1426e-05 -
accuracy: 1.0000
4/4 [==============================] - 3s 608ms/step - loss: 0.0046 - accuracy:
0.9967
Epoch 1/5
12/12 [==============================] - 47s 4s/step - loss: 3.9494e-05 -
accuracy: 1.0000
Epoch 2/5
12/12 [==============================] - 47s 4s/step - loss: 1.3085e-05 -
accuracy: 1.0000
Epoch 3/5
12/12 [==============================] - 47s 4s/step - loss: 6.9050e-06 -
accuracy: 1.0000
Epoch 4/5
```

```
12/12 [==============================] - 47s 4s/step - loss: 9.3699e-06 -
accuracy: 1.0000
Epoch 5/5
12/12 [==============================] - 47s 4s/step - loss: 1.6326e-05 -
accuracy: 1.0000
4/4 [==============================] - 3s 610ms/step - loss: 0.0067 - accuracy:
0.9956
Epoch 1/5
12/12 [==============================] - 47s 4s/step - loss: 2.0180 - accuracy:
0.5350
Epoch 2/5
12/12 [==============================] - 47s 4s/step - loss: 0.6690 - accuracy:
0.7573
Epoch 3/5
12/12 [==============================] - 47s 4s/step - loss: 0.1405 - accuracy:
0.9580
Epoch 4/5
12/12 [==============================] - 47s 4s/step - loss: 0.0173 - accuracy:
0.9947
Epoch 5/5
12/12 [==============================] - 47s 4s/step - loss: 0.0017 - accuracy:
0.9997
4/4 [==============================] - 3s 605ms/step - loss: 1.2195 - accuracy:
0.8356

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Epoch 1/5
12/12 [==============================] - 47s 4s/step - loss: 1.4791 - accuracy:
0.4710
Epoch 2/5
12/12 [==============================] - 47s 4s/step - loss: 0.9551 - accuracy:
0.5193
Epoch 3/5
12/12 [==============================] - 47s 4s/step - loss: 0.7062 - accuracy:
0.7203
Epoch 4/5
12/12 [==============================] - 47s 4s/step - loss: 0.2897 - accuracy:
0.9103
Epoch 5/5
```

```
12/12 [==============================] - 47s 4s/step - loss: 0.4447 - accuracy:
0.8530
4/4 [==============================] - 3s 607ms/step - loss: 0.1730 - accuracy:
0.9756
Epoch 1/5
12/12 [==============================] - 47s 4s/step - loss: 0.1956 - accuracy:
0.9643
Epoch 2/5
12/12 [==============================] - 47s 4s/step - loss: 0.0212 - accuracy:
0.9923
Epoch 3/5
12/12 [==============================] - 47s 4s/step - loss: 0.0126 - accuracy:
0.9963
Epoch 4/5
12/12 [==============================] - 47s 4s/step - loss: 0.0145 - accuracy:
0.9953
Epoch 5/5
12/12 [==============================] - 47s 4s/step - loss: 0.0058 - accuracy:
0.9990
4/4 [==============================] - 3s 607ms/step - loss: 0.0456 - accuracy:
0.9878
Epoch 1/5
12/12 [==============================] - 47s 4s/step - loss: 1.1611e-05 -
accuracy: 1.0000
Epoch 2/5
12/12 [==============================] - 47s 4s/step - loss: 1.0533e-05 -
accuracy: 1.0000
Epoch 3/5
12/12 [==============================] - 47s 4s/step - loss: 1.4400e-05 -
accuracy: 1.0000
Epoch 4/5
12/12 [==============================] - 47s 4s/step - loss: 1.3293e-05 -
accuracy: 1.0000
Epoch 5/5
12/12 [==============================] - 47s 4s/step - loss: 2.9600e-05 -
accuracy: 1.0000
4/4 [==============================] - 3s 607ms/step - loss: 0.0367 - accuracy:
0.9889
Epoch 1/5
12/12 [==============================] - 47s 4s/step - loss: 0.0031 - accuracy:
0.9990
Epoch 2/5
12/12 [==============================] - 47s 4s/step - loss: 5.6019e-04 -
accuracy: 1.0000
Epoch 3/5
12/12 [==============================] - 47s 4s/step - loss: 3.8462e-04 -
accuracy: 1.0000
Epoch 4/5
```

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12/12 [==============================] - 47s 4s/step - loss: 2.5892e-04 -
accuracy: 1.0000
Epoch 5/5
12/12 [==============================] - 47s 4s/step - loss: 1.8904e-04 -
accuracy: 1.0000
4/4 [==============================] - 3s 605ms/step - loss: 0.0528 - accuracy:
0.9878
Epoch 1/5
12/12 [==============================] - 47s 4s/step - loss: 0.0050 - accuracy:
0.9980
Epoch 2/5
12/12 [==============================] - 47s 4s/step - loss: 0.0043 - accuracy:
0.9993
Epoch 3/5
12/12 [==============================] - 47s 4s/step - loss: 9.1133e-04 -
accuracy: 0.9997
Epoch 4/5
12/12 [==============================] - 47s 4s/step - loss: 6.4910e-04 -
accuracy: 1.0000
Epoch 5/5
12/12 [==============================] - 47s 4s/step - loss: 7.6486e-04 -
accuracy: 0.9997
4/4 [==============================] - 3s 614ms/step - loss: 0.0775 - accuracy:
0.9822

100%|      | 30/30 [00:00<00:00, 77.12it/s]
100%|      | 30/30 [00:00<00:00, 92.53it/s]
100%|      | 30/30 [00:00<00:00, 88.75it/s]
100%|      | 30/30 [00:00<00:00, 96.05it/s]
100%|      | 30/30 [00:00<00:00, 81.31it/s]
100%|      | 30/30 [00:00<00:00, 85.34it/s]
100%|      | 30/30 [00:00<00:00, 85.38it/s]
100%|      | 30/30 [00:00<00:00, 85.83it/s]
100%|      | 30/30 [00:00<00:00, 78.69it/s]
100%|      | 30/30 [00:00<00:00, 99.84it/s]
100%|      | 30/30 [00:00<00:00, 84.56it/s]
100%|      | 30/30 [00:00<00:00, 88.30it/s]
100%|      | 30/30 [00:00<00:00, 79.79it/s]
100%|      | 30/30 [00:00<00:00, 86.96it/s]
100%|      | 30/30 [00:00<00:00, 79.09it/s]
100%|      | 30/30 [00:00<00:00, 100.33it/s]
100%|      | 30/30 [00:00<00:00, 89.24it/s]
100%|      | 30/30 [00:00<00:00, 90.54it/s]
100%|      | 30/30 [00:00<00:00, 98.87it/s]
100%|      | 30/30 [00:00<00:00, 94.22it/s]
100%|      | 30/30 [00:00<00:00, 91.09it/s]
100%|      | 30/30 [00:00<00:00, 101.18it/s]
100%|      | 30/30 [00:00<00:00, 93.88it/s]
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100%|      | 30/30 [00:00<00:00, 88.54it/s]
100%|      | 30/30 [00:00<00:00, 88.57it/s]
100%|      | 30/30 [00:00<00:00, 80.70it/s]
100%|      | 30/30 [00:00<00:00, 84.90it/s]
100%|      | 30/30 [00:00<00:00, 87.99it/s]
100%|      | 30/30 [00:00<00:00, 94.51it/s]
100%|      | 30/30 [00:00<00:00, 80.66it/s]
100%|      | 30/30 [00:00<00:00, 100.02it/s]
100%|      | 30/30 [00:00<00:00, 98.86it/s]
100%|      | 30/30 [00:00<00:00, 85.11it/s]
100%|      | 30/30 [00:00<00:00, 87.83it/s]
100%|      | 30/30 [00:00<00:00, 91.55it/s]
100%|      | 30/30 [00:00<00:00, 94.12it/s]
100%|      | 30/30 [00:00<00:00, 94.03it/s]
100%|      | 30/30 [00:00<00:00, 83.61it/s]
100%|      | 30/30 [00:00<00:00, 91.21it/s]
100%|      | 30/30 [00:00<00:00, 97.55it/s]
100%|      | 30/30 [00:00<00:00, 95.87it/s]
100%|      | 30/30 [00:00<00:00, 99.59it/s]
100%|      | 30/30 [00:00<00:00, 101.96it/s]
100%|      | 30/30 [00:00<00:00, 79.69it/s]
100%|      | 30/30 [00:00<00:00, 94.27it/s]
100%|      | 30/30 [00:00<00:00, 99.10it/s]
100%|      | 30/30 [00:00<00:00, 87.77it/s]
100%|      | 30/30 [00:00<00:00, 98.57it/s]
100%|      | 30/30 [00:00<00:00, 104.79it/s]
100%|      | 30/30 [00:00<00:00, 96.89it/s]
100%|      | 30/30 [00:00<00:00, 89.78it/s]
100%|      | 30/30 [00:00<00:00, 83.18it/s]
100%|      | 30/30 [00:00<00:00, 92.39it/s]
100%|      | 30/30 [00:00<00:00, 80.09it/s]
100%|      | 30/30 [00:00<00:00, 100.88it/s]
100%|      | 30/30 [00:00<00:00, 104.33it/s]
100%|      | 30/30 [00:00<00:00, 95.34it/s]
100%|      | 30/30 [00:00<00:00, 102.26it/s]
100%|      | 30/30 [00:00<00:00, 92.94it/s]
100%|      | 30/30 [00:00<00:00, 86.12it/s]
100%|      | 30/30 [00:00<00:00, 83.83it/s]
100%|      | 30/30 [00:00<00:00, 96.84it/s]
100%|      | 30/30 [00:00<00:00, 93.54it/s]
100%|      | 30/30 [00:00<00:00, 92.77it/s]
100%|      | 30/30 [00:00<00:00, 88.58it/s]
100%|      | 30/30 [00:00<00:00, 95.39it/s]
100%|      | 30/30 [00:00<00:00, 88.35it/s]
100%|      | 30/30 [00:00<00:00, 84.54it/s]
100%|      | 30/30 [00:00<00:00, 86.46it/s]
100%|      | 30/30 [00:00<00:00, 95.74it/s]
100%|      | 30/30 [00:00<00:00, 87.59it/s]
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100%|      | 30/30 [00:00<00:00, 83.47it/s]
100%|      | 30/30 [00:00<00:00, 80.64it/s]
100%|      | 30/30 [00:00<00:00, 95.37it/s]
100%|      | 30/30 [00:00<00:00, 87.15it/s]
100%|      | 30/30 [00:00<00:00, 94.06it/s]
100%|      | 30/30 [00:00<00:00, 84.79it/s]
100%|      | 30/30 [00:00<00:00, 95.41it/s]
100%|      | 30/30 [00:00<00:00, 94.20it/s]
100%|      | 30/30 [00:00<00:00, 90.61it/s]
100%|      | 30/30 [00:00<00:00, 90.96it/s]
100%|      | 30/30 [00:00<00:00, 83.89it/s]
100%|      | 30/30 [00:00<00:00, 93.83it/s]
100%|      | 30/30 [00:00<00:00, 96.46it/s]
100%|      | 30/30 [00:00<00:00, 81.31it/s]
100%|      | 30/30 [00:00<00:00, 88.17it/s]
100%|      | 30/30 [00:00<00:00, 93.76it/s]
100%|      | 30/30 [00:00<00:00, 90.62it/s]
100%|      | 30/30 [00:00<00:00, 86.90it/s]
100%|      | 30/30 [00:00<00:00, 82.22it/s]
100%|      | 30/30 [00:00<00:00, 77.68it/s]
100%|      | 30/30 [00:00<00:00, 96.20it/s]
100%|      | 30/30 [00:00<00:00, 102.06it/s]
100%|      | 30/30 [00:00<00:00, 86.81it/s]
100%|      | 30/30 [00:00<00:00, 80.58it/s]
100%|      | 30/30 [00:00<00:00, 81.72it/s]
100%|      | 30/30 [00:00<00:00, 81.07it/s]
100%|      | 30/30 [00:00<00:00, 95.56it/s]
100%|      | 30/30 [00:00<00:00, 96.68it/s]

Epoch 1/5
12/12 [==============================] - 47s 4s/step - loss: 0.8070 - accuracy:
0.7850
Epoch 2/5
12/12 [==============================] - 47s 4s/step - loss: 0.4927 - accuracy:
0.8140
Epoch 3/5
12/12 [==============================] - 47s 4s/step - loss: 0.3298 - accuracy:
0.8533
Epoch 4/5
12/12 [==============================] - 47s 4s/step - loss: 0.2610 - accuracy:
0.8927
Epoch 5/5
12/12 [==============================] - 47s 4s/step - loss: 0.2270 - accuracy:
0.9043
4/4 [==============================] - 3s 612ms/step - loss: 0.1409 - accuracy:
0.9589

100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
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100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.60it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.62it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.61it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.61it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.60it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
```

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100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.60it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.61it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.45it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.60it/s]
```

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100%|      | 30/30 [00:08<00:00,  3.46it/s]

Epoch 1/5
12/12 [==============================] - 47s 4s/step - loss: 0.0117 - accuracy:
0.9997
Epoch 2/5
12/12 [==============================] - 47s 4s/step - loss: 0.0020 - accuracy:
1.0000
Epoch 3/5
12/12 [==============================] - 47s 4s/step - loss: 2.1463e-04 -
accuracy: 1.0000
Epoch 4/5
12/12 [==============================] - 47s 4s/step - loss: 2.1800e-04 -
accuracy: 1.0000
Epoch 5/5
12/12 [==============================] - 47s 4s/step - loss: 2.5295e-04 -
accuracy: 1.0000
4/4 [==============================] - 3s 610ms/step - loss: 0.0792 - accuracy:
0.9656

100%|      | 30/30 [00:00<00:00, 97.29it/s]
100%|      | 30/30 [00:00<00:00, 82.81it/s]
100%|      | 30/30 [00:00<00:00, 89.46it/s]
100%|      | 30/30 [00:00<00:00, 93.38it/s]
100%|      | 30/30 [00:00<00:00, 97.44it/s]
100%|      | 30/30 [00:00<00:00, 90.50it/s]
100%|      | 30/30 [00:00<00:00, 88.12it/s]
100%|      | 30/30 [00:00<00:00, 84.20it/s]
100%|      | 30/30 [00:00<00:00, 84.77it/s]
100%|      | 30/30 [00:00<00:00, 96.18it/s]
100%|      | 30/30 [00:00<00:00, 92.84it/s]
100%|      | 30/30 [00:00<00:00, 85.53it/s]
100%|      | 30/30 [00:00<00:00, 100.52it/s]
100%|      | 30/30 [00:00<00:00, 85.78it/s]
100%|      | 30/30 [00:00<00:00, 87.36it/s]
100%|      | 30/30 [00:00<00:00, 86.65it/s]
100%|      | 30/30 [00:00<00:00, 96.07it/s]
100%|      | 30/30 [00:00<00:00, 93.32it/s]
100%|      | 30/30 [00:00<00:00, 93.96it/s]
100%|      | 30/30 [00:00<00:00, 94.58it/s]
100%|      | 30/30 [00:00<00:00, 80.82it/s]
100%|      | 30/30 [00:00<00:00, 88.36it/s]
100%|      | 30/30 [00:00<00:00, 90.24it/s]
100%|      | 30/30 [00:00<00:00, 92.81it/s]
100%|      | 30/30 [00:00<00:00, 95.83it/s]
100%|      | 30/30 [00:00<00:00, 94.29it/s]
100%|      | 30/30 [00:00<00:00, 88.83it/s]
100%|      | 30/30 [00:00<00:00, 98.32it/s]
100%|      | 30/30 [00:00<00:00, 86.54it/s]
```

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100%|      | 30/30 [00:00<00:00, 86.77it/s]
100%|      | 30/30 [00:00<00:00, 100.67it/s]
100%|      | 30/30 [00:00<00:00, 82.69it/s]
100%|      | 30/30 [00:00<00:00, 86.23it/s]
100%|      | 30/30 [00:00<00:00, 80.64it/s]
100%|      | 30/30 [00:00<00:00, 98.34it/s]
100%|      | 30/30 [00:00<00:00, 97.80it/s]
100%|      | 30/30 [00:00<00:00, 89.59it/s]
100%|      | 30/30 [00:00<00:00, 84.00it/s]
100%|      | 30/30 [00:00<00:00, 88.09it/s]
100%|      | 30/30 [00:00<00:00, 74.21it/s]
100%|      | 30/30 [00:00<00:00, 92.46it/s]
100%|      | 30/30 [00:00<00:00, 91.17it/s]
100%|      | 30/30 [00:00<00:00, 83.18it/s]
100%|      | 30/30 [00:00<00:00, 94.09it/s]
100%|      | 30/30 [00:00<00:00, 102.38it/s]
100%|      | 30/30 [00:00<00:00, 93.92it/s]
100%|      | 30/30 [00:00<00:00, 81.30it/s]
100%|      | 30/30 [00:00<00:00, 97.99it/s]
100%|      | 30/30 [00:00<00:00, 92.77it/s]
100%|      | 30/30 [00:00<00:00, 89.19it/s]
100%|      | 30/30 [00:00<00:00, 81.76it/s]
100%|      | 30/30 [00:00<00:00, 79.54it/s]
100%|      | 30/30 [00:00<00:00, 92.06it/s]
100%|      | 30/30 [00:00<00:00, 99.18it/s]
100%|      | 30/30 [00:00<00:00, 85.26it/s]
100%|      | 30/30 [00:00<00:00, 95.19it/s]
100%|      | 30/30 [00:00<00:00, 99.22it/s]
100%|      | 30/30 [00:00<00:00, 93.83it/s]
100%|      | 30/30 [00:00<00:00, 81.46it/s]
100%|      | 30/30 [00:00<00:00, 97.95it/s]
100%|      | 30/30 [00:00<00:00, 93.49it/s]
100%|      | 30/30 [00:00<00:00, 82.61it/s]
100%|      | 30/30 [00:00<00:00, 96.03it/s]
100%|      | 30/30 [00:00<00:00, 86.57it/s]
100%|      | 30/30 [00:00<00:00, 80.97it/s]
100%|      | 30/30 [00:00<00:00, 90.28it/s]
100%|      | 30/30 [00:00<00:00, 95.70it/s]
100%|      | 30/30 [00:00<00:00, 88.47it/s]
100%|      | 30/30 [00:00<00:00, 84.28it/s]
100%|      | 30/30 [00:00<00:00, 93.52it/s]
100%|      | 30/30 [00:00<00:00, 93.00it/s]
100%|      | 30/30 [00:00<00:00, 99.48it/s]
100%|      | 30/30 [00:00<00:00, 97.91it/s]
100%|      | 30/30 [00:00<00:00, 97.02it/s]
100%|      | 30/30 [00:00<00:00, 93.98it/s]
100%|      | 30/30 [00:00<00:00, 81.31it/s]
100%|      | 30/30 [00:00<00:00, 91.30it/s]
```

```
100%|      | 30/30 [00:00<00:00, 91.40it/s]
100%|      | 30/30 [00:00<00:00, 87.81it/s]
100%|      | 30/30 [00:00<00:00, 96.70it/s]
100%|      | 30/30 [00:00<00:00, 87.39it/s]
100%|      | 30/30 [00:00<00:00, 97.83it/s]
100%|      | 30/30 [00:00<00:00, 101.59it/s]
100%|      | 30/30 [00:00<00:00, 88.82it/s]
100%|      | 30/30 [00:00<00:00, 90.28it/s]
100%|      | 30/30 [00:00<00:00, 83.86it/s]
100%|      | 30/30 [00:00<00:00, 86.02it/s]
100%|      | 30/30 [00:00<00:00, 84.26it/s]
100%|      | 30/30 [00:00<00:00, 94.89it/s]
100%|      | 30/30 [00:00<00:00, 90.99it/s]
100%|      | 30/30 [00:00<00:00, 89.54it/s]
100%|      | 30/30 [00:00<00:00, 85.23it/s]
100%|      | 30/30 [00:00<00:00, 92.25it/s]
100%|      | 30/30 [00:00<00:00, 87.94it/s]
100%|      | 30/30 [00:00<00:00, 98.58it/s]
100%|      | 30/30 [00:00<00:00, 79.75it/s]
100%|      | 30/30 [00:00<00:00, 95.10it/s]
100%|      | 30/30 [00:00<00:00, 94.95it/s]
100%|      | 30/30 [00:00<00:00, 86.37it/s]

Epoch 1/5
12/12 [==============================] - 47s 4s/step - loss: 0.0340 - accuracy:
0.9843
Epoch 2/5
12/12 [==============================] - 47s 4s/step - loss: 0.0093 - accuracy:
0.9987
Epoch 3/5
12/12 [==============================] - 47s 4s/step - loss: 0.0047 - accuracy:
0.9997
Epoch 4/5
12/12 [==============================] - 47s 4s/step - loss: 0.0026 - accuracy:
1.0000
Epoch 5/5
12/12 [==============================] - 47s 4s/step - loss: 0.0015 - accuracy:
1.0000
4/4 [==============================] - 3s 606ms/step - loss: 0.0591 - accuracy:
0.9789

100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:03<00:00,  7.62it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.28it/s]
```

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100%|      | 30/30 [00:03<00:00,  7.71it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
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100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.72it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:03<00:00,  7.76it/s]
100%|      | 30/30 [00:03<00:00,  7.70it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:04<00:00,  7.38it/s]
100%|      | 30/30 [00:04<00:00,  7.28it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.66it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:04<00:00,  7.36it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:04<00:00,  7.37it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:04<00:00,  7.30it/s]
100%|      | 30/30 [00:03<00:00,  7.65it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:04<00:00,  7.50it/s]
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
```

```
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:03<00:00,  7.71it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:03<00:00,  7.67it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.63it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.35it/s]
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.67it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:04<00:00,  7.35it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:04<00:00,  7.31it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:03<00:00,  7.67it/s]
100%|      | 30/30 [00:04<00:00,  7.34it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.42it/s]

Epoch 1/5
12/12 [==============================] - 47s 4s/step - loss: 0.0019 - accuracy:
0.9997
Epoch 2/5
```

```
12/12 [==============================] - 47s 4s/step - loss: 0.0027 - accuracy:
0.9993
Epoch 3/5
12/12 [==============================] - 47s 4s/step - loss: 0.0017 - accuracy:
1.0000
Epoch 4/5
12/12 [==============================] - 47s 4s/step - loss: 8.3627e-04 -
accuracy: 0.9997
Epoch 5/5
12/12 [==============================] - 47s 4s/step - loss: 7.8137e-04 -
accuracy: 1.0000
4/4 [==============================] - 3s 610ms/step - loss: 0.0976 - accuracy:
0.9722
Accuracy - None::  0.41333332657814026
Accuracy - jitter::  0.996666669845581
Accuracy - scaling::  0.995555579662323
Accuracy - rotation::  0.8355555534362793
Accuracy - permutation::  0.9755555391311646
Accuracy - magnitude_warp::  0.9877777695655823
Accuracy - time_warp::  0.9888888597488403
Accuracy - window_slice::  0.9877777695655823
Accuracy - window_warp::  0.9822221994400024
Accuracy - spawner::  0.9588888883590698
Accuracy - wdba::  0.9655555486679077
Accuracy - random_guided_warp::  0.9788888692855835
Accuracy - discriminative_guided_warp::  0.9722222089767456
```

lstm1

[ ]:
```
model = get_model("lstm1", input_shape, nb_class)
model.compile(optimizer=optm, loss='categorical_crossentropy',␣
 ↪metrics=['accuracy'])
method_apply_deep(model, x_train, y_train, x_test, y_test)
```

```
Model: "model_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_2 (InputLayer)        [(None, 128, 1)]          0

 lstm (LSTM)                 (None, 100)               40800

 dense_3 (Dense)             (None, 3)                 303

=================================================================
Total params: 41,103
Trainable params: 41,103
Non-trainable params: 0
```

```
----------------------------------------------------------------
Epoch 1/5
1/1 [==============================] - 2s 2s/step - loss: 1.0986 - accuracy:
0.4000
Epoch 2/5
1/1 [==============================] - 0s 95ms/step - loss: 1.0984 - accuracy:
0.4000
Epoch 3/5
1/1 [==============================] - 0s 91ms/step - loss: 1.0980 - accuracy:
0.4000
Epoch 4/5
1/1 [==============================] - 0s 97ms/step - loss: 1.0974 - accuracy:
0.4000
Epoch 5/5
1/1 [==============================] - 0s 86ms/step - loss: 1.0967 - accuracy:
0.4000
4/4 [==============================] - 1s 134ms/step - loss: 1.0995 - accuracy:
0.3311
Epoch 1/5
12/12 [==============================] - 6s 383ms/step - loss: 1.0912 -
accuracy: 0.4000
Epoch 2/5
12/12 [==============================] - 5s 380ms/step - loss: 1.0844 -
accuracy: 0.4000
Epoch 3/5
12/12 [==============================] - 5s 384ms/step - loss: 1.0802 -
accuracy: 0.4000
Epoch 4/5
12/12 [==============================] - 5s 381ms/step - loss: 1.0766 -
accuracy: 0.4000
Epoch 5/5
12/12 [==============================] - 5s 383ms/step - loss: 1.0730 -
accuracy: 0.4197
4/4 [==============================] - 1s 139ms/step - loss: 1.0959 - accuracy:
0.4289
Epoch 1/5
12/12 [==============================] - 5s 383ms/step - loss: 1.0689 -
accuracy: 0.4800
Epoch 2/5
12/12 [==============================] - 5s 383ms/step - loss: 1.0642 -
accuracy: 0.4727
Epoch 3/5
12/12 [==============================] - 5s 381ms/step - loss: 1.0577 -
accuracy: 0.5330
Epoch 4/5
12/12 [==============================] - 5s 382ms/step - loss: 1.0485 -
accuracy: 0.5857
Epoch 5/5
```

```
12/12 [==============================] - 5s 385ms/step - loss: 1.0332 -
accuracy: 0.5887
4/4 [==============================] - 1s 140ms/step - loss: 1.0431 - accuracy:
0.5333
Epoch 1/5
12/12 [==============================] - 5s 391ms/step - loss: 1.1659 -
accuracy: 0.4547
Epoch 2/5
12/12 [==============================] - 5s 386ms/step - loss: 1.1104 -
accuracy: 0.3560
Epoch 3/5
12/12 [==============================] - 5s 386ms/step - loss: 1.0914 -
accuracy: 0.3533
Epoch 4/5
12/12 [==============================] - 5s 387ms/step - loss: 1.0867 -
accuracy: 0.4750
Epoch 5/5
12/12 [==============================] - 5s 386ms/step - loss: 1.0857 -
accuracy: 0.4043
4/4 [==============================] - 1s 135ms/step - loss: 1.1047 - accuracy:
0.3311

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Epoch 1/5
12/12 [==============================] - 5s 385ms/step - loss: 1.0850 -
accuracy: 0.4000
Epoch 2/5
12/12 [==============================] - 5s 387ms/step - loss: 1.0845 -
accuracy: 0.4000
Epoch 3/5
12/12 [==============================] - 5s 385ms/step - loss: 1.0843 -
accuracy: 0.4000
Epoch 4/5
12/12 [==============================] - 5s 384ms/step - loss: 1.0842 -
accuracy: 0.4000
Epoch 5/5
12/12 [==============================] - 5s 389ms/step - loss: 1.0839 -
accuracy: 0.4000
4/4 [==============================] - 1s 132ms/step - loss: 1.1023 - accuracy:
```

```
0.3311
Epoch 1/5
12/12 [==============================] - 5s 392ms/step - loss: 1.0727 -
accuracy: 0.4000
Epoch 2/5
12/12 [==============================] - 5s 384ms/step - loss: 1.0679 -
accuracy: 0.4320
Epoch 3/5
12/12 [==============================] - 5s 390ms/step - loss: 1.0582 -
accuracy: 0.4997
Epoch 4/5
12/12 [==============================] - 5s 380ms/step - loss: 1.0412 -
accuracy: 0.5200
Epoch 5/5
12/12 [==============================] - 5s 385ms/step - loss: 1.0070 -
accuracy: 0.4807
4/4 [==============================] - 1s 134ms/step - loss: 0.9885 - accuracy:
0.4433
Epoch 1/5
12/12 [==============================] - 5s 388ms/step - loss: 0.9612 -
accuracy: 0.5213
Epoch 2/5
12/12 [==============================] - 5s 383ms/step - loss: 0.9315 -
accuracy: 0.5413
Epoch 3/5
12/12 [==============================] - 5s 381ms/step - loss: 0.9051 -
accuracy: 0.5057
Epoch 4/5
12/12 [==============================] - 5s 381ms/step - loss: 0.8762 -
accuracy: 0.5437
Epoch 5/5
12/12 [==============================] - 5s 380ms/step - loss: 0.8441 -
accuracy: 0.5647
4/4 [==============================] - 1s 132ms/step - loss: 0.8006 - accuracy:
0.6100
Epoch 1/5
12/12 [==============================] - 5s 386ms/step - loss: 0.8607 -
accuracy: 0.5750
Epoch 2/5
12/12 [==============================] - 5s 381ms/step - loss: 0.7276 -
accuracy: 0.6603
Epoch 3/5
12/12 [==============================] - 5s 378ms/step - loss: 0.6518 -
accuracy: 0.6983
Epoch 4/5
12/12 [==============================] - 5s 385ms/step - loss: 0.5741 -
accuracy: 0.7283
Epoch 5/5
```

```
12/12 [==============================] - 5s 385ms/step - loss: 0.4656 -
accuracy: 0.8427
4/4 [==============================] - 1s 138ms/step - loss: 0.7569 - accuracy:
0.6856
Epoch 1/5
12/12 [==============================] - 5s 387ms/step - loss: 0.9616 -
accuracy: 0.5487
Epoch 2/5
12/12 [==============================] - 5s 386ms/step - loss: 1.0236 -
accuracy: 0.4380
Epoch 3/5
12/12 [==============================] - 5s 382ms/step - loss: 1.0043 -
accuracy: 0.4750
Epoch 4/5
12/12 [==============================] - 5s 383ms/step - loss: 0.8957 -
accuracy: 0.5837
Epoch 5/5
12/12 [==============================] - 5s 383ms/step - loss: 1.1422 -
accuracy: 0.4003
4/4 [==============================] - 1s 141ms/step - loss: 1.1177 - accuracy:
0.4700

100%|      | 30/30 [00:00<00:00, 96.83it/s]
100%|      | 30/30 [00:00<00:00, 103.79it/s]
100%|      | 30/30 [00:00<00:00, 87.21it/s]
100%|      | 30/30 [00:00<00:00, 81.14it/s]
100%|      | 30/30 [00:00<00:00, 89.58it/s]
100%|      | 30/30 [00:00<00:00, 92.29it/s]
100%|      | 30/30 [00:00<00:00, 78.99it/s]
100%|      | 30/30 [00:00<00:00, 92.57it/s]
100%|      | 30/30 [00:00<00:00, 96.42it/s]
100%|      | 30/30 [00:00<00:00, 98.02it/s]
100%|      | 30/30 [00:00<00:00, 96.73it/s]
100%|      | 30/30 [00:00<00:00, 84.56it/s]
100%|      | 30/30 [00:00<00:00, 86.68it/s]
100%|      | 30/30 [00:00<00:00, 88.82it/s]
100%|      | 30/30 [00:00<00:00, 82.60it/s]
100%|      | 30/30 [00:00<00:00, 77.59it/s]
100%|      | 30/30 [00:00<00:00, 100.95it/s]
100%|      | 30/30 [00:00<00:00, 97.11it/s]
100%|      | 30/30 [00:00<00:00, 92.16it/s]
100%|      | 30/30 [00:00<00:00, 94.93it/s]
100%|      | 30/30 [00:00<00:00, 91.28it/s]
100%|      | 30/30 [00:00<00:00, 87.05it/s]
100%|      | 30/30 [00:00<00:00, 98.49it/s]
100%|      | 30/30 [00:00<00:00, 87.94it/s]
100%|      | 30/30 [00:00<00:00, 77.75it/s]
100%|      | 30/30 [00:00<00:00, 91.07it/s]
```

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100%|      | 30/30 [00:00<00:00, 85.80it/s]
100%|      | 30/30 [00:00<00:00, 85.07it/s]
100%|      | 30/30 [00:00<00:00, 96.12it/s]
100%|      | 30/30 [00:00<00:00, 94.54it/s]
100%|      | 30/30 [00:00<00:00, 81.43it/s]
100%|      | 30/30 [00:00<00:00, 86.98it/s]
100%|      | 30/30 [00:00<00:00, 99.01it/s]
100%|      | 30/30 [00:00<00:00, 89.76it/s]
100%|      | 30/30 [00:00<00:00, 85.85it/s]
100%|      | 30/30 [00:00<00:00, 90.93it/s]
100%|      | 30/30 [00:00<00:00, 87.16it/s]
100%|      | 30/30 [00:00<00:00, 85.06it/s]
100%|      | 30/30 [00:00<00:00, 97.82it/s]
100%|      | 30/30 [00:00<00:00, 91.54it/s]
100%|      | 30/30 [00:00<00:00, 90.44it/s]
100%|      | 30/30 [00:00<00:00, 84.52it/s]
100%|      | 30/30 [00:00<00:00, 78.27it/s]
100%|      | 30/30 [00:00<00:00, 96.97it/s]
100%|      | 30/30 [00:00<00:00, 89.68it/s]
100%|      | 30/30 [00:00<00:00, 100.74it/s]
100%|      | 30/30 [00:00<00:00, 101.36it/s]
100%|      | 30/30 [00:00<00:00, 85.56it/s]
100%|      | 30/30 [00:00<00:00, 93.58it/s]
100%|      | 30/30 [00:00<00:00, 101.02it/s]
100%|      | 30/30 [00:00<00:00, 93.94it/s]
100%|      | 30/30 [00:00<00:00, 101.70it/s]
100%|      | 30/30 [00:00<00:00, 91.18it/s]
100%|      | 30/30 [00:00<00:00, 82.53it/s]
100%|      | 30/30 [00:00<00:00, 92.40it/s]
100%|      | 30/30 [00:00<00:00, 97.28it/s]
100%|      | 30/30 [00:00<00:00, 90.02it/s]
100%|      | 30/30 [00:00<00:00, 84.96it/s]
100%|      | 30/30 [00:00<00:00, 89.35it/s]
100%|      | 30/30 [00:00<00:00, 91.88it/s]
100%|      | 30/30 [00:00<00:00, 81.93it/s]
100%|      | 30/30 [00:00<00:00, 87.18it/s]
100%|      | 30/30 [00:00<00:00, 91.46it/s]
100%|      | 30/30 [00:00<00:00, 87.38it/s]
100%|      | 30/30 [00:00<00:00, 91.90it/s]
100%|      | 30/30 [00:00<00:00, 90.30it/s]
100%|      | 30/30 [00:00<00:00, 101.06it/s]
100%|      | 30/30 [00:00<00:00, 98.91it/s]
100%|      | 30/30 [00:00<00:00, 92.96it/s]
100%|      | 30/30 [00:00<00:00, 96.27it/s]
100%|      | 30/30 [00:00<00:00, 100.59it/s]
100%|      | 30/30 [00:00<00:00, 87.32it/s]
100%|      | 30/30 [00:00<00:00, 88.22it/s]
100%|      | 30/30 [00:00<00:00, 85.62it/s]
```

```
100%|      | 30/30 [00:00<00:00, 83.34it/s]
100%|      | 30/30 [00:00<00:00, 98.55it/s]
100%|      | 30/30 [00:00<00:00, 93.69it/s]
100%|      | 30/30 [00:00<00:00, 93.76it/s]
100%|      | 30/30 [00:00<00:00, 95.80it/s]
100%|      | 30/30 [00:00<00:00, 85.55it/s]
100%|      | 30/30 [00:00<00:00, 74.71it/s]
100%|      | 30/30 [00:00<00:00, 83.94it/s]
100%|      | 30/30 [00:00<00:00, 96.13it/s]
100%|      | 30/30 [00:00<00:00, 85.25it/s]
100%|      | 30/30 [00:00<00:00, 87.86it/s]
100%|      | 30/30 [00:00<00:00, 92.18it/s]
100%|      | 30/30 [00:00<00:00, 93.06it/s]
100%|      | 30/30 [00:00<00:00, 100.91it/s]
100%|      | 30/30 [00:00<00:00, 79.20it/s]
100%|      | 30/30 [00:00<00:00, 87.24it/s]
100%|      | 30/30 [00:00<00:00, 82.51it/s]
100%|      | 30/30 [00:00<00:00, 81.70it/s]
100%|      | 30/30 [00:00<00:00, 87.22it/s]
100%|      | 30/30 [00:00<00:00, 76.59it/s]
100%|      | 30/30 [00:00<00:00, 86.18it/s]
100%|      | 30/30 [00:00<00:00, 100.41it/s]
100%|      | 30/30 [00:00<00:00, 84.80it/s]
100%|      | 30/30 [00:00<00:00, 92.14it/s]
100%|      | 30/30 [00:00<00:00, 98.70it/s]

Epoch 1/5
12/12 [==============================] - 5s 390ms/step - loss: 1.0721 -
accuracy: 0.4123
Epoch 2/5
12/12 [==============================] - 5s 384ms/step - loss: 1.0420 -
accuracy: 0.5163
Epoch 3/5
12/12 [==============================] - 5s 382ms/step - loss: 1.0353 -
accuracy: 0.5053
Epoch 4/5
12/12 [==============================] - 5s 387ms/step - loss: 1.0268 -
accuracy: 0.5607
Epoch 5/5
12/12 [==============================] - 5s 385ms/step - loss: 1.0186 -
accuracy: 0.5693
4/4 [==============================] - 1s 142ms/step - loss: 1.0461 - accuracy:
0.4678

100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
```

```
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.60it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.45it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.43it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.43it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
```

```
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.45it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]

Epoch 1/5
```

```
12/12 [==============================] - 5s 387ms/step - loss: 1.0170 -
accuracy: 0.6400
Epoch 2/5
12/12 [==============================] - 5s 387ms/step - loss: 0.9967 -
accuracy: 0.6743
Epoch 3/5
12/12 [==============================] - 5s 385ms/step - loss: 0.9655 -
accuracy: 0.7137
Epoch 4/5
12/12 [==============================] - 5s 381ms/step - loss: 0.9043 -
accuracy: 0.6660
Epoch 5/5
12/12 [==============================] - 5s 389ms/step - loss: 0.8145 -
accuracy: 0.6223
4/4 [==============================] - 1s 135ms/step - loss: 1.0575 - accuracy:
0.4778

100%|      | 30/30 [00:00<00:00, 80.64it/s]
100%|      | 30/30 [00:00<00:00, 88.72it/s]
100%|      | 30/30 [00:00<00:00, 99.71it/s]
100%|      | 30/30 [00:00<00:00, 90.02it/s]
100%|      | 30/30 [00:00<00:00, 94.62it/s]
100%|      | 30/30 [00:00<00:00, 87.64it/s]
100%|      | 30/30 [00:00<00:00, 81.25it/s]
100%|      | 30/30 [00:00<00:00, 93.04it/s]
100%|      | 30/30 [00:00<00:00, 98.06it/s]
100%|      | 30/30 [00:00<00:00, 75.44it/s]
100%|      | 30/30 [00:00<00:00, 103.26it/s]
100%|      | 30/30 [00:00<00:00, 101.19it/s]
100%|      | 30/30 [00:00<00:00, 71.12it/s]
100%|      | 30/30 [00:00<00:00, 95.57it/s]
100%|      | 30/30 [00:00<00:00, 77.02it/s]
100%|      | 30/30 [00:00<00:00, 91.49it/s]
100%|      | 30/30 [00:00<00:00, 96.25it/s]
100%|      | 30/30 [00:00<00:00, 100.99it/s]
100%|      | 30/30 [00:00<00:00, 75.91it/s]
100%|      | 30/30 [00:00<00:00, 101.29it/s]
100%|      | 30/30 [00:00<00:00, 101.41it/s]
100%|      | 30/30 [00:00<00:00, 84.33it/s]
100%|      | 30/30 [00:00<00:00, 103.27it/s]
100%|      | 30/30 [00:00<00:00, 103.63it/s]
100%|      | 30/30 [00:00<00:00, 92.47it/s]
100%|      | 30/30 [00:00<00:00, 91.09it/s]
100%|      | 30/30 [00:00<00:00, 89.61it/s]
100%|      | 30/30 [00:00<00:00, 86.26it/s]
100%|      | 30/30 [00:00<00:00, 94.63it/s]
100%|      | 30/30 [00:00<00:00, 91.04it/s]
100%|      | 30/30 [00:00<00:00, 80.11it/s]
```

```
100%|      | 30/30 [00:00<00:00, 87.07it/s]
100%|      | 30/30 [00:00<00:00, 93.48it/s]
100%|      | 30/30 [00:00<00:00, 78.31it/s]
100%|      | 30/30 [00:00<00:00, 101.62it/s]
100%|      | 30/30 [00:00<00:00, 102.85it/s]
100%|      | 30/30 [00:00<00:00, 91.03it/s]
100%|      | 30/30 [00:00<00:00, 92.03it/s]
100%|      | 30/30 [00:00<00:00, 81.75it/s]
100%|      | 30/30 [00:00<00:00, 92.10it/s]
100%|      | 30/30 [00:00<00:00, 94.31it/s]
100%|      | 30/30 [00:00<00:00, 85.71it/s]
100%|      | 30/30 [00:00<00:00, 85.43it/s]
100%|      | 30/30 [00:00<00:00, 88.73it/s]
100%|      | 30/30 [00:00<00:00, 70.61it/s]
100%|      | 30/30 [00:00<00:00, 88.33it/s]
100%|      | 30/30 [00:00<00:00, 88.11it/s]
100%|      | 30/30 [00:00<00:00, 89.40it/s]
100%|      | 30/30 [00:00<00:00, 80.19it/s]
100%|      | 30/30 [00:00<00:00, 90.71it/s]
100%|      | 30/30 [00:00<00:00, 86.95it/s]
100%|      | 30/30 [00:00<00:00, 98.94it/s]
100%|      | 30/30 [00:00<00:00, 99.44it/s]
100%|      | 30/30 [00:00<00:00, 88.15it/s]
100%|      | 30/30 [00:00<00:00, 102.53it/s]
100%|      | 30/30 [00:00<00:00, 100.05it/s]
100%|      | 30/30 [00:00<00:00, 90.58it/s]
100%|      | 30/30 [00:00<00:00, 89.81it/s]
100%|      | 30/30 [00:00<00:00, 102.40it/s]
100%|      | 30/30 [00:00<00:00, 81.28it/s]
100%|      | 30/30 [00:00<00:00, 88.52it/s]
100%|      | 30/30 [00:00<00:00, 84.98it/s]
100%|      | 30/30 [00:00<00:00, 93.91it/s]
100%|      | 30/30 [00:00<00:00, 100.54it/s]
100%|      | 30/30 [00:00<00:00, 93.15it/s]
100%|      | 30/30 [00:00<00:00, 92.21it/s]
100%|      | 30/30 [00:00<00:00, 90.72it/s]
100%|      | 30/30 [00:00<00:00, 86.01it/s]
100%|      | 30/30 [00:00<00:00, 95.65it/s]
100%|      | 30/30 [00:00<00:00, 94.99it/s]
100%|      | 30/30 [00:00<00:00, 88.83it/s]
100%|      | 30/30 [00:00<00:00, 84.53it/s]
100%|      | 30/30 [00:00<00:00, 89.29it/s]
100%|      | 30/30 [00:00<00:00, 84.52it/s]
100%|      | 30/30 [00:00<00:00, 86.50it/s]
100%|      | 30/30 [00:00<00:00, 85.17it/s]
100%|      | 30/30 [00:00<00:00, 100.21it/s]
100%|      | 30/30 [00:00<00:00, 92.15it/s]
100%|      | 30/30 [00:00<00:00, 100.30it/s]
```

```
100%|      | 30/30 [00:00<00:00, 98.33it/s]
100%|      | 30/30 [00:00<00:00, 87.73it/s]
100%|      | 30/30 [00:00<00:00, 89.86it/s]
100%|      | 30/30 [00:00<00:00, 86.17it/s]
100%|      | 30/30 [00:00<00:00, 96.99it/s]
100%|      | 30/30 [00:00<00:00, 95.94it/s]
100%|      | 30/30 [00:00<00:00, 86.29it/s]
100%|      | 30/30 [00:00<00:00, 95.57it/s]
100%|      | 30/30 [00:00<00:00, 96.14it/s]
100%|      | 30/30 [00:00<00:00, 98.81it/s]
100%|      | 30/30 [00:00<00:00, 93.37it/s]
100%|      | 30/30 [00:00<00:00, 83.68it/s]
100%|      | 30/30 [00:00<00:00, 82.99it/s]
100%|      | 30/30 [00:00<00:00, 100.75it/s]
100%|      | 30/30 [00:00<00:00, 94.09it/s]
100%|      | 30/30 [00:00<00:00, 89.41it/s]
100%|      | 30/30 [00:00<00:00, 99.84it/s]
100%|      | 30/30 [00:00<00:00, 92.29it/s]
100%|      | 30/30 [00:00<00:00, 101.53it/s]
100%|      | 30/30 [00:00<00:00, 100.36it/s]
```

```
Epoch 1/5
12/12 [==============================] - 5s 385ms/step - loss: 0.9694 -
accuracy: 0.6227
Epoch 2/5
12/12 [==============================] - 5s 383ms/step - loss: 0.9362 -
accuracy: 0.6370
Epoch 3/5
12/12 [==============================] - 5s 386ms/step - loss: 0.9038 -
accuracy: 0.6350
Epoch 4/5
12/12 [==============================] - 5s 384ms/step - loss: 0.8820 -
accuracy: 0.6730
Epoch 5/5
12/12 [==============================] - 5s 380ms/step - loss: 0.8616 -
accuracy: 0.6743
4/4 [==============================] - 1s 142ms/step - loss: 0.9053 - accuracy:
0.5489
```

```
100%|      | 30/30 [00:04<00:00,  7.50it/s]
100%|      | 30/30 [00:03<00:00,  7.66it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.38it/s]
100%|      | 30/30 [00:03<00:00,  7.71it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
```

```
100%|      | 30/30 [00:03<00:00,  7.72it/s]
100%|      | 30/30 [00:03<00:00,  7.63it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:04<00:00,  7.36it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:03<00:00,  7.50it/s]
100%|      | 30/30 [00:04<00:00,  7.23it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:04<00:00,  7.42it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:03<00:00,  7.74it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.70it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.42it/s]
100%|      | 30/30 [00:03<00:00,  7.68it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.80it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
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100%|      | 30/30 [00:03<00:00,  7.70it/s]
100%|      | 30/30 [00:03<00:00,  7.83it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:03<00:00,  7.62it/s]
100%|      | 30/30 [00:03<00:00,  7.77it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:03<00:00,  7.65it/s]
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100%|      | 30/30 [00:03<00:00,  7.69it/s]
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100%|      | 30/30 [00:04<00:00,  7.26it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:03<00:00,  7.68it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
```

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100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:03<00:00,  7.71it/s]
100%|      | 30/30 [00:04<00:00,  7.38it/s]
100%|      | 30/30 [00:03<00:00,  7.70it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:04<00:00,  7.28it/s]
100%|      | 30/30 [00:03<00:00,  7.62it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:03<00:00,  7.62it/s]
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100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:03<00:00,  7.68it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
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100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:03<00:00,  7.68it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.72it/s]
100%|      | 30/30 [00:03<00:00,  7.78it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.63it/s]

Epoch 1/5
12/12 [==============================] - 5s 386ms/step - loss: 0.8277 -
accuracy: 0.6927
Epoch 2/5
12/12 [==============================] - 5s 383ms/step - loss: 0.8119 -
accuracy: 0.6800
```

```
Epoch 3/5
12/12 [==============================] - 5s 385ms/step - loss: 0.8175 -
accuracy: 0.6720
Epoch 4/5
12/12 [==============================] - 5s 382ms/step - loss: 0.7328 -
accuracy: 0.7277
Epoch 5/5
12/12 [==============================] - 5s 382ms/step - loss: 0.6547 -
accuracy: 0.7450
4/4 [==============================] - 1s 133ms/step - loss: 1.0023 - accuracy:
0.5300
Accuracy - None::  0.3311111032962799
Accuracy - jitter::  0.42888888716697693
Accuracy - scaling::  0.5333333611488342
Accuracy - rotation::  0.3311111032962799
Accuracy - permutation::  0.3311111032962799
Accuracy - magnitude_warp::  0.44333332777023315
Accuracy - time_warp::  0.6100000143051147
Accuracy - window_slice::  0.6855555772781372
Accuracy - window_warp::  0.4699999988079071
Accuracy - spawner::  0.4677777886390686
Accuracy - wdba::  0.47777777910232544
Accuracy - random_guided_warp::  0.5488888621330261
Accuracy - discriminative_guided_warp::  0.5299999713897705
```

lstm

[ ]:
```
model = get_model("lstm", input_shape, nb_class)
model.compile(optimizer=optm, loss='categorical_crossentropy',␣
 ↪metrics=['accuracy'])
method_apply_deep(model, x_train, y_train, x_test, y_test)
```

```
Model: "model_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_3 (InputLayer)        [(None, 128, 1)]          0

 lstm_1 (LSTM)               (None, 512)               1052672

 dense_4 (Dense)             (None, 3)                 1539

=================================================================
Total params: 1,054,211
Trainable params: 1,054,211
Non-trainable params: 0
_________________________________________________________________
Epoch 1/5
```

```
1/1 [==============================] - 3s 3s/step - loss: 1.0970 - accuracy:
0.3667
Epoch 2/5
1/1 [==============================] - 1s 1s/step - loss: 1.0968 - accuracy:
0.3333
Epoch 3/5
1/1 [==============================] - 1s 1s/step - loss: 1.0964 - accuracy:
0.3333
Epoch 4/5
1/1 [==============================] - 1s 1s/step - loss: 1.0960 - accuracy:
0.3000
Epoch 5/5
1/1 [==============================] - 1s 1s/step - loss: 1.0954 - accuracy:
0.4333
4/4 [==============================] - 6s 1s/step - loss: 1.0978 - accuracy:
0.5111
Epoch 1/5
12/12 [==============================] - 56s 5s/step - loss: 1.0904 - accuracy:
0.4180
Epoch 2/5
12/12 [==============================] - 55s 5s/step - loss: 1.0837 - accuracy:
0.4000
Epoch 3/5
12/12 [==============================] - 54s 5s/step - loss: 1.0811 - accuracy:
0.4000
Epoch 4/5
12/12 [==============================] - 55s 5s/step - loss: 1.0784 - accuracy:
0.4000
Epoch 5/5
12/12 [==============================] - 55s 5s/step - loss: 1.0756 - accuracy:
0.4000
4/4 [==============================] - 5s 1s/step - loss: 1.1001 - accuracy:
0.3344
Epoch 1/5
12/12 [==============================] - 55s 5s/step - loss: 1.0728 - accuracy:
0.4040
Epoch 2/5
12/12 [==============================] - 55s 5s/step - loss: 1.0697 - accuracy:
0.4140
Epoch 3/5
12/12 [==============================] - 54s 5s/step - loss: 1.0659 - accuracy:
0.4350
Epoch 4/5
12/12 [==============================] - 54s 5s/step - loss: 1.0611 - accuracy:
0.5110
Epoch 5/5
12/12 [==============================] - 54s 5s/step - loss: 1.0545 - accuracy:
0.5717
```

```
4/4 [==============================] - 5s 1s/step - loss: 1.0741 - accuracy:
0.5267
Epoch 1/5
12/12 [==============================] - 55s 5s/step - loss: 1.1167 - accuracy:
0.5083
Epoch 2/5
12/12 [==============================] - 55s 5s/step - loss: 1.0999 - accuracy:
0.3847
Epoch 3/5
12/12 [==============================] - 54s 5s/step - loss: 1.0917 - accuracy:
0.3387
Epoch 4/5
12/12 [==============================] - 54s 5s/step - loss: 1.0887 - accuracy:
0.3700
Epoch 5/5
12/12 [==============================] - 55s 5s/step - loss: 1.0873 - accuracy:
0.4747
4/4 [==============================] - 5s 1s/step - loss: 1.0969 - accuracy:
0.5200

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Epoch 1/5
12/12 [==============================] - 55s 5s/step - loss: 1.0845 - accuracy:
0.4467
Epoch 2/5
12/12 [==============================] - 55s 5s/step - loss: 1.0839 - accuracy:
0.4000
Epoch 3/5
12/12 [==============================] - 55s 5s/step - loss: 1.0838 - accuracy:
0.4000
Epoch 4/5
12/12 [==============================] - 54s 5s/step - loss: 1.0837 - accuracy:
0.4000
Epoch 5/5
12/12 [==============================] - 54s 5s/step - loss: 1.0835 - accuracy:
0.4000
4/4 [==============================] - 5s 1s/step - loss: 1.0982 - accuracy:
0.3311
Epoch 1/5
```

```
12/12 [==============================] - 54s 5s/step - loss: 1.0718 - accuracy:
0.4020
Epoch 2/5
12/12 [==============================] - 54s 5s/step - loss: 1.0688 - accuracy:
0.4200
Epoch 3/5
12/12 [==============================] - 54s 5s/step - loss: 1.0635 - accuracy:
0.4737
Epoch 4/5
12/12 [==============================] - 54s 5s/step - loss: 1.0551 - accuracy:
0.5080
Epoch 5/5
12/12 [==============================] - 54s 5s/step - loss: 1.0404 - accuracy:
0.5280
4/4 [==============================] - 5s 1s/step - loss: 1.0490 - accuracy:
0.5467
Epoch 1/5
12/12 [==============================] - 53s 4s/step - loss: 1.0009 - accuracy:
0.6093
Epoch 2/5
12/12 [==============================] - 54s 4s/step - loss: 0.9429 - accuracy:
0.5510
Epoch 3/5
12/12 [==============================] - 54s 4s/step - loss: 0.9065 - accuracy:
0.5580
Epoch 4/5
12/12 [==============================] - 53s 4s/step - loss: 0.8714 - accuracy:
0.5533
Epoch 5/5
12/12 [==============================] - 53s 4s/step - loss: 0.8388 - accuracy:
0.5567
4/4 [==============================] - 5s 1s/step - loss: 0.7981 - accuracy:
0.5722
Epoch 1/5
12/12 [==============================] - 53s 4s/step - loss: 0.8362 - accuracy:
0.5653
Epoch 2/5
12/12 [==============================] - 53s 4s/step - loss: 0.8968 - accuracy:
0.5527
Epoch 3/5
12/12 [==============================] - 53s 4s/step - loss: 0.8307 - accuracy:
0.5687
Epoch 4/5
12/12 [==============================] - 54s 4s/step - loss: 0.7132 - accuracy:
0.6307
Epoch 5/5
12/12 [==============================] - 53s 4s/step - loss: 0.6913 - accuracy:
0.6587
```

```
4/4 [==============================] - 5s 1s/step - loss: 0.7577 - accuracy:
0.5889
Epoch 1/5
12/12 [==============================] - 53s 4s/step - loss: 0.6797 - accuracy:
0.6823
Epoch 2/5
12/12 [==============================] - 53s 4s/step - loss: 0.6043 - accuracy:
0.7060
Epoch 3/5
12/12 [==============================] - 54s 4s/step - loss: 0.6032 - accuracy:
0.7013
Epoch 4/5
12/12 [==============================] - 53s 4s/step - loss: 0.5979 - accuracy:
0.7073
Epoch 5/5
12/12 [==============================] - 53s 4s/step - loss: 0.5473 - accuracy:
0.7613
4/4 [==============================] - 5s 1s/step - loss: 0.5256 - accuracy:
0.7844
```

```
100%|      | 30/30 [00:00<00:00, 83.73it/s]
100%|      | 30/30 [00:00<00:00, 88.27it/s]
100%|      | 30/30 [00:00<00:00, 83.46it/s]
100%|      | 30/30 [00:00<00:00, 78.69it/s]
100%|      | 30/30 [00:00<00:00, 82.69it/s]
100%|      | 30/30 [00:00<00:00, 77.24it/s]
100%|      | 30/30 [00:00<00:00, 91.45it/s]
100%|      | 30/30 [00:00<00:00, 82.76it/s]
100%|      | 30/30 [00:00<00:00, 93.02it/s]
100%|      | 30/30 [00:00<00:00, 97.23it/s]
100%|      | 30/30 [00:00<00:00, 103.37it/s]
100%|      | 30/30 [00:00<00:00, 83.60it/s]
100%|      | 30/30 [00:00<00:00, 91.88it/s]
100%|      | 30/30 [00:00<00:00, 89.65it/s]
100%|      | 30/30 [00:00<00:00, 81.23it/s]
100%|      | 30/30 [00:00<00:00, 89.42it/s]
100%|      | 30/30 [00:00<00:00, 85.30it/s]
100%|      | 30/30 [00:00<00:00, 83.74it/s]
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100%|      | 30/30 [00:00<00:00, 92.54it/s]
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100%|      | 30/30 [00:00<00:00, 82.85it/s]
100%|      | 30/30 [00:00<00:00, 84.04it/s]
100%|      | 30/30 [00:00<00:00, 88.26it/s]
100%|      | 30/30 [00:00<00:00, 88.54it/s]
100%|      | 30/30 [00:00<00:00, 87.11it/s]
```

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100%|      | 30/30 [00:00<00:00, 78.29it/s]
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100%|      | 30/30 [00:00<00:00, 80.95it/s]
100%|      | 30/30 [00:00<00:00, 95.79it/s]
100%|      | 30/30 [00:00<00:00, 91.16it/s]
100%|      | 30/30 [00:00<00:00, 83.36it/s]
100%|      | 30/30 [00:00<00:00, 84.78it/s]
100%|      | 30/30 [00:00<00:00, 99.48it/s]
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100%|      | 30/30 [00:00<00:00, 86.90it/s]
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100%|      | 30/30 [00:00<00:00, 85.89it/s]
100%|      | 30/30 [00:00<00:00, 78.83it/s]
100%|      | 30/30 [00:00<00:00, 93.73it/s]
100%|      | 30/30 [00:00<00:00, 78.88it/s]
100%|      | 30/30 [00:00<00:00, 82.89it/s]
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100%|      | 30/30 [00:00<00:00, 102.12it/s]
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100%|      | 30/30 [00:00<00:00, 91.86it/s]
100%|      | 30/30 [00:00<00:00, 83.39it/s]
100%|      | 30/30 [00:00<00:00, 97.68it/s]
100%|      | 30/30 [00:00<00:00, 91.53it/s]
100%|      | 30/30 [00:00<00:00, 101.64it/s]
100%|      | 30/30 [00:00<00:00, 86.07it/s]
100%|      | 30/30 [00:00<00:00, 98.48it/s]
100%|      | 30/30 [00:00<00:00, 92.33it/s]
100%|      | 30/30 [00:00<00:00, 84.23it/s]
100%|      | 30/30 [00:00<00:00, 84.39it/s]
100%|      | 30/30 [00:00<00:00, 85.43it/s]
100%|      | 30/30 [00:00<00:00, 90.43it/s]
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100%|      | 30/30 [00:00<00:00, 99.33it/s]
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100%|      | 30/30 [00:00<00:00, 84.07it/s]
100%|      | 30/30 [00:00<00:00, 89.27it/s]
100%|      | 30/30 [00:00<00:00, 84.92it/s]
100%|      | 30/30 [00:00<00:00, 83.59it/s]
100%|      | 30/30 [00:00<00:00, 87.41it/s]
```

```
100%|      | 30/30 [00:00<00:00, 95.04it/s]
100%|      | 30/30 [00:00<00:00, 91.79it/s]
100%|      | 30/30 [00:00<00:00, 88.19it/s]
100%|      | 30/30 [00:00<00:00, 99.46it/s]
100%|      | 30/30 [00:00<00:00, 83.22it/s]
100%|      | 30/30 [00:00<00:00, 99.75it/s]
100%|      | 30/30 [00:00<00:00, 89.20it/s]
100%|      | 30/30 [00:00<00:00, 94.88it/s]
100%|      | 30/30 [00:00<00:00, 85.91it/s]
100%|      | 30/30 [00:00<00:00, 82.24it/s]
100%|      | 30/30 [00:00<00:00, 89.54it/s]
100%|      | 30/30 [00:00<00:00, 96.58it/s]
100%|      | 30/30 [00:00<00:00, 80.33it/s]
100%|      | 30/30 [00:00<00:00, 89.23it/s]
100%|      | 30/30 [00:00<00:00, 99.34it/s]
100%|      | 30/30 [00:00<00:00, 91.98it/s]
100%|      | 30/30 [00:00<00:00, 94.60it/s]
100%|      | 30/30 [00:00<00:00, 99.34it/s]
100%|      | 30/30 [00:00<00:00, 95.42it/s]
100%|      | 30/30 [00:00<00:00, 80.82it/s]
100%|      | 30/30 [00:00<00:00, 98.82it/s]
100%|      | 30/30 [00:00<00:00, 86.79it/s]
100%|      | 30/30 [00:00<00:00, 81.44it/s]

Epoch 1/5
12/12 [==============================] - 54s 5s/step - loss: 0.6356 - accuracy:
0.7177
Epoch 2/5
12/12 [==============================] - 54s 5s/step - loss: 0.6289 - accuracy:
0.7267
Epoch 3/5
12/12 [==============================] - 54s 4s/step - loss: 0.6207 - accuracy:
0.7260
Epoch 4/5
12/12 [==============================] - 54s 4s/step - loss: 0.6126 - accuracy:
0.7327
Epoch 5/5
12/12 [==============================] - 54s 4s/step - loss: 0.6302 - accuracy:
0.7120
4/4 [==============================] - 5s 1s/step - loss: 0.4569 - accuracy:
0.8167

100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
```

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100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.45it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
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100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.45it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.44it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]

Epoch 1/5
12/12 [==============================] - 53s 4s/step - loss: 0.3445 - accuracy:
0.9287
```

```
Epoch 2/5
12/12 [==============================] - 53s 4s/step - loss: 1.4270 - accuracy:
0.4257
Epoch 3/5
12/12 [==============================] - 53s 4s/step - loss: 1.0905 - accuracy:
0.3583
Epoch 4/5
12/12 [==============================] - 53s 4s/step - loss: 1.0690 - accuracy:
0.4740
Epoch 5/5
12/12 [==============================] - 54s 4s/step - loss: 1.0632 - accuracy:
0.4103
4/4 [==============================] - 5s 1s/step - loss: 1.0882 - accuracy:
0.3633

100%|      | 30/30 [00:00<00:00, 78.70it/s]
100%|      | 30/30 [00:00<00:00, 101.37it/s]
100%|      | 30/30 [00:00<00:00, 81.84it/s]
100%|      | 30/30 [00:00<00:00, 94.71it/s]
100%|      | 30/30 [00:00<00:00, 100.78it/s]
100%|      | 30/30 [00:00<00:00, 97.61it/s]
100%|      | 30/30 [00:00<00:00, 103.82it/s]
100%|      | 30/30 [00:00<00:00, 89.13it/s]
100%|      | 30/30 [00:00<00:00, 95.20it/s]
100%|      | 30/30 [00:00<00:00, 99.45it/s]
100%|      | 30/30 [00:00<00:00, 88.91it/s]
100%|      | 30/30 [00:00<00:00, 97.06it/s]
100%|      | 30/30 [00:00<00:00, 102.04it/s]
100%|      | 30/30 [00:00<00:00, 91.80it/s]
100%|      | 30/30 [00:00<00:00, 100.28it/s]
100%|      | 30/30 [00:00<00:00, 89.88it/s]
100%|      | 30/30 [00:00<00:00, 85.50it/s]
100%|      | 30/30 [00:00<00:00, 99.96it/s]
100%|      | 30/30 [00:00<00:00, 90.25it/s]
100%|      | 30/30 [00:00<00:00, 89.89it/s]
100%|      | 30/30 [00:00<00:00, 91.71it/s]
100%|      | 30/30 [00:00<00:00, 95.37it/s]
100%|      | 30/30 [00:00<00:00, 91.23it/s]
100%|      | 30/30 [00:00<00:00, 84.51it/s]
100%|      | 30/30 [00:00<00:00, 82.97it/s]
100%|      | 30/30 [00:00<00:00, 87.52it/s]
100%|      | 30/30 [00:00<00:00, 83.46it/s]
100%|      | 30/30 [00:00<00:00, 85.24it/s]
100%|      | 30/30 [00:00<00:00, 89.36it/s]
100%|      | 30/30 [00:00<00:00, 88.40it/s]
100%|      | 30/30 [00:00<00:00, 86.71it/s]
100%|      | 30/30 [00:00<00:00, 92.63it/s]
100%|      | 30/30 [00:00<00:00, 93.48it/s]
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100%|      | 30/30 [00:00<00:00, 82.31it/s]
100%|      | 30/30 [00:00<00:00, 91.41it/s]
100%|      | 30/30 [00:00<00:00, 87.50it/s]
100%|      | 30/30 [00:00<00:00, 88.83it/s]
100%|      | 30/30 [00:00<00:00, 90.58it/s]
100%|      | 30/30 [00:00<00:00, 86.33it/s]
100%|      | 30/30 [00:00<00:00, 94.60it/s]
100%|      | 30/30 [00:00<00:00, 91.97it/s]
100%|      | 30/30 [00:00<00:00, 89.42it/s]
100%|      | 30/30 [00:00<00:00, 91.20it/s]
100%|      | 30/30 [00:00<00:00, 80.81it/s]
100%|      | 30/30 [00:00<00:00, 88.32it/s]
100%|      | 30/30 [00:00<00:00, 102.17it/s]
100%|      | 30/30 [00:00<00:00, 97.56it/s]
100%|      | 30/30 [00:00<00:00, 82.06it/s]
100%|      | 30/30 [00:00<00:00, 89.11it/s]
100%|      | 30/30 [00:00<00:00, 85.10it/s]
100%|      | 30/30 [00:00<00:00, 84.15it/s]
100%|      | 30/30 [00:00<00:00, 81.90it/s]
100%|      | 30/30 [00:00<00:00, 91.82it/s]
100%|      | 30/30 [00:00<00:00, 93.84it/s]
100%|      | 30/30 [00:00<00:00, 94.10it/s]
100%|      | 30/30 [00:00<00:00, 98.58it/s]
100%|      | 30/30 [00:00<00:00, 95.93it/s]
100%|      | 30/30 [00:00<00:00, 100.40it/s]
100%|      | 30/30 [00:00<00:00, 90.13it/s]
100%|      | 30/30 [00:00<00:00, 86.09it/s]
100%|      | 30/30 [00:00<00:00, 100.07it/s]
100%|      | 30/30 [00:00<00:00, 86.07it/s]
100%|      | 30/30 [00:00<00:00, 76.25it/s]
100%|      | 30/30 [00:00<00:00, 98.27it/s]
100%|      | 30/30 [00:00<00:00, 98.47it/s]
100%|      | 30/30 [00:00<00:00, 93.88it/s]
100%|      | 30/30 [00:00<00:00, 99.56it/s]
100%|      | 30/30 [00:00<00:00, 87.82it/s]
100%|      | 30/30 [00:00<00:00, 100.10it/s]
100%|      | 30/30 [00:00<00:00, 102.52it/s]
100%|      | 30/30 [00:00<00:00, 98.41it/s]
100%|      | 30/30 [00:00<00:00, 100.37it/s]
100%|      | 30/30 [00:00<00:00, 90.63it/s]
100%|      | 30/30 [00:00<00:00, 85.19it/s]
100%|      | 30/30 [00:00<00:00, 93.80it/s]
100%|      | 30/30 [00:00<00:00, 77.54it/s]
100%|      | 30/30 [00:00<00:00, 88.85it/s]
100%|      | 30/30 [00:00<00:00, 91.79it/s]
100%|      | 30/30 [00:00<00:00, 92.88it/s]
100%|      | 30/30 [00:00<00:00, 82.55it/s]
100%|      | 30/30 [00:00<00:00, 88.56it/s]
```

```
100%|      | 30/30 [00:00<00:00, 87.28it/s]
100%|      | 30/30 [00:00<00:00, 77.31it/s]
100%|      | 30/30 [00:00<00:00, 86.85it/s]
100%|      | 30/30 [00:00<00:00, 86.83it/s]
100%|      | 30/30 [00:00<00:00, 86.84it/s]
100%|      | 30/30 [00:00<00:00, 102.04it/s]
100%|      | 30/30 [00:00<00:00, 97.05it/s]
100%|      | 30/30 [00:00<00:00, 82.79it/s]
100%|      | 30/30 [00:00<00:00, 85.97it/s]
100%|      | 30/30 [00:00<00:00, 93.86it/s]
100%|      | 30/30 [00:00<00:00, 95.66it/s]
100%|      | 30/30 [00:00<00:00, 99.87it/s]
100%|      | 30/30 [00:00<00:00, 97.46it/s]
100%|      | 30/30 [00:00<00:00, 99.02it/s]
100%|      | 30/30 [00:00<00:00, 89.42it/s]
100%|      | 30/30 [00:00<00:00, 87.80it/s]
100%|      | 30/30 [00:00<00:00, 82.88it/s]
100%|      | 30/30 [00:00<00:00, 90.94it/s]

Epoch 1/5
12/12 [==============================] - 54s 4s/step - loss: 1.0696 - accuracy:
0.4120
Epoch 2/5
12/12 [==============================] - 54s 5s/step - loss: 1.0678 - accuracy:
0.4263
Epoch 3/5
12/12 [==============================] - 54s 5s/step - loss: 1.0665 - accuracy:
0.4837
Epoch 4/5
12/12 [==============================] - 55s 5s/step - loss: 1.0654 - accuracy:
0.5330
Epoch 5/5
12/12 [==============================] - 54s 4s/step - loss: 1.0641 - accuracy:
0.5303
4/4 [==============================] - 5s 1s/step - loss: 1.0817 - accuracy:
0.4844

100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.62it/s]
100%|      | 30/30 [00:03<00:00,  7.67it/s]
100%|      | 30/30 [00:04<00:00,  7.34it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
```

```
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:03<00:00,  7.50it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.70it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:04<00:00,  7.50it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.37it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:03<00:00,  7.68it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
```

```
100%|      | 30/30 [00:03<00:00,  7.62it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:03<00:00,  7.75it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:04<00:00,  7.27it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:03<00:00,  7.67it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:03<00:00,  7.63it/s]
100%|      | 30/30 [00:03<00:00,  7.70it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.50it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:03<00:00,  7.80it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:03<00:00,  7.66it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:03<00:00,  7.61it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.63it/s]
100%|      | 30/30 [00:04<00:00,  7.31it/s]
100%|      | 30/30 [00:03<00:00,  7.62it/s]

Epoch 1/5
12/12 [==============================] - 53s 4s/step - loss: 1.0596 - accuracy:
0.5270
Epoch 2/5
12/12 [==============================] - 53s 4s/step - loss: 1.0571 - accuracy:
0.5520
Epoch 3/5
12/12 [==============================] - 53s 4s/step - loss: 1.0538 - accuracy:
```

```
0.5743
Epoch 4/5
12/12 [==============================] - 53s 4s/step - loss: 1.0498 - accuracy:
0.5900
Epoch 5/5
12/12 [==============================] - 53s 4s/step - loss: 1.0442 - accuracy:
0.5980
4/4 [==============================] - 5s 1s/step - loss: 1.0629 - accuracy:
0.5089
Accuracy - None::  0.5111111402511597
Accuracy - jitter::  0.33444443345069885
Accuracy - scaling::  0.5266666412353516
Accuracy - rotation::  0.5199999809265137
Accuracy - permutation::  0.3311111032962799
Accuracy - magnitude_warp::  0.54666668176651
Accuracy - time_warp::  0.5722222328186035
Accuracy - window_slice::  0.5888888835906982
Accuracy - window_warp::  0.7844444513320923
Accuracy - spawner::  0.8166666626930237
Accuracy - wdba::  0.3633333444595337
Accuracy - random_guided_warp::  0.48444443941116333
Accuracy - discriminative_guided_warp::  0.5088889002799988
```

lstm2

[ ]:
```
model = get_model("lstm2", input_shape, nb_class)
model.compile(optimizer=optm, loss='categorical_crossentropy',␣
 ↪metrics=['accuracy'])
method_apply_deep(model, x_train, y_train, x_test, y_test)
```

```
Model: "model_3"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_4 (InputLayer)        [(None, 128, 1)]          0

 lstm_2 (LSTM)               (None, 128, 100)          40800

 lstm_3 (LSTM)               (None, 100)               80400

 dense_5 (Dense)             (None, 3)                 303

=================================================================
Total params: 121,503
Trainable params: 121,503
Non-trainable params: 0
_________________________________________________________________
Epoch 1/5
```

```
1/1 [==============================] - 4s 4s/step - loss: 1.0995 - accuracy:
0.3333
Epoch 2/5
1/1 [==============================] - 0s 205ms/step - loss: 1.0993 - accuracy:
0.3667
Epoch 3/5
1/1 [==============================] - 0s 205ms/step - loss: 1.0989 - accuracy:
0.3667
Epoch 4/5
1/1 [==============================] - 0s 182ms/step - loss: 1.0984 - accuracy:
0.3333
Epoch 5/5
1/1 [==============================] - 0s 193ms/step - loss: 1.0978 - accuracy:
0.4000
4/4 [==============================] - 3s 301ms/step - loss: 1.0985 - accuracy:
0.3311
Epoch 1/5
12/12 [==============================] - 14s 946ms/step - loss: 1.0925 -
accuracy: 0.4000
Epoch 2/5
12/12 [==============================] - 11s 930ms/step - loss: 1.0852 -
accuracy: 0.4000
Epoch 3/5
12/12 [==============================] - 11s 935ms/step - loss: 1.0814 -
accuracy: 0.4000
Epoch 4/5
12/12 [==============================] - 11s 935ms/step - loss: 1.0792 -
accuracy: 0.4000
Epoch 5/5
12/12 [==============================] - 11s 940ms/step - loss: 1.0764 -
accuracy: 0.4000
4/4 [==============================] - 1s 302ms/step - loss: 1.1013 - accuracy:
0.3311
Epoch 1/5
12/12 [==============================] - 11s 932ms/step - loss: 1.0733 -
accuracy: 0.4037
Epoch 2/5
12/12 [==============================] - 11s 935ms/step - loss: 1.0695 -
accuracy: 0.4283
Epoch 3/5
12/12 [==============================] - 11s 931ms/step - loss: 1.0650 -
accuracy: 0.4570
Epoch 4/5
12/12 [==============================] - 11s 928ms/step - loss: 1.0595 -
accuracy: 0.5077
Epoch 5/5
12/12 [==============================] - 11s 936ms/step - loss: 1.0516 -
accuracy: 0.5617
```

```
4/4 [==============================] - 1s 304ms/step - loss: 1.0713 - accuracy:
0.5189
Epoch 1/5
12/12 [==============================] - 11s 936ms/step - loss: 1.1073 -
accuracy: 0.4777
Epoch 2/5
12/12 [==============================] - 11s 932ms/step - loss: 1.0953 -
accuracy: 0.3990
Epoch 3/5
12/12 [==============================] - 11s 934ms/step - loss: 1.0901 -
accuracy: 0.3923
Epoch 4/5
12/12 [==============================] - 11s 927ms/step - loss: 1.0863 -
accuracy: 0.4067
Epoch 5/5
12/12 [==============================] - 11s 935ms/step - loss: 1.0852 -
accuracy: 0.4783
4/4 [==============================] - 1s 304ms/step - loss: 1.0886 - accuracy:
0.5144

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Epoch 1/5
12/12 [==============================] - 11s 929ms/step - loss: 1.0820 -
accuracy: 0.4933
Epoch 2/5
12/12 [==============================] - 11s 942ms/step - loss: 1.0816 -
accuracy: 0.4417
Epoch 3/5
12/12 [==============================] - 11s 931ms/step - loss: 1.0815 -
accuracy: 0.4143
Epoch 4/5
12/12 [==============================] - 11s 932ms/step - loss: 1.0816 -
accuracy: 0.4030
Epoch 5/5
12/12 [==============================] - 11s 937ms/step - loss: 1.0814 -
accuracy: 0.4303
4/4 [==============================] - 1s 305ms/step - loss: 1.0902 - accuracy:
0.4444
Epoch 1/5
```

```
12/12 [==============================] - 11s 929ms/step - loss: 1.0647 -
accuracy: 0.4913
Epoch 2/5
12/12 [==============================] - 11s 937ms/step - loss: 1.0594 -
accuracy: 0.5043
Epoch 3/5
12/12 [==============================] - 11s 941ms/step - loss: 1.0506 -
accuracy: 0.5240
Epoch 4/5
12/12 [==============================] - 11s 941ms/step - loss: 1.0377 -
accuracy: 0.5140
Epoch 5/5
12/12 [==============================] - 11s 952ms/step - loss: 1.0199 -
accuracy: 0.4863
4/4 [==============================] - 1s 305ms/step - loss: 1.0267 - accuracy:
0.4033
Epoch 1/5
12/12 [==============================] - 11s 942ms/step - loss: 0.9929 -
accuracy: 0.4323
Epoch 2/5
12/12 [==============================] - 11s 939ms/step - loss: 0.9694 -
accuracy: 0.4670
Epoch 3/5
12/12 [==============================] - 11s 943ms/step - loss: 0.9473 -
accuracy: 0.5270
Epoch 4/5
12/12 [==============================] - 11s 949ms/step - loss: 0.9204 -
accuracy: 0.5260
Epoch 5/5
12/12 [==============================] - 11s 949ms/step - loss: 0.8833 -
accuracy: 0.5823
4/4 [==============================] - 1s 303ms/step - loss: 0.8650 - accuracy:
0.5511
Epoch 1/5
12/12 [==============================] - 11s 950ms/step - loss: 0.8788 -
accuracy: 0.5590
Epoch 2/5
12/12 [==============================] - 11s 937ms/step - loss: 0.8480 -
accuracy: 0.5760
Epoch 3/5
12/12 [==============================] - 11s 944ms/step - loss: 0.8229 -
accuracy: 0.5793
Epoch 4/5
12/12 [==============================] - 11s 945ms/step - loss: 0.8105 -
accuracy: 0.5840
Epoch 5/5
12/12 [==============================] - 11s 937ms/step - loss: 0.7956 -
accuracy: 0.5883
```

```
4/4 [==============================] - 1s 302ms/step - loss: 0.7894 - accuracy:
0.6167
Epoch 1/5
12/12 [==============================] - 11s 943ms/step - loss: 0.7986 -
accuracy: 0.5937
Epoch 2/5
12/12 [==============================] - 11s 939ms/step - loss: 0.7809 -
accuracy: 0.6023
Epoch 3/5
12/12 [==============================] - 11s 949ms/step - loss: 0.7638 -
accuracy: 0.6120
Epoch 4/5
12/12 [==============================] - 11s 947ms/step - loss: 0.7566 -
accuracy: 0.6047
Epoch 5/5
12/12 [==============================] - 11s 949ms/step - loss: 0.7361 -
accuracy: 0.6117
4/4 [==============================] - 1s 310ms/step - loss: 0.6606 - accuracy:
0.6744

100%|      | 30/30 [00:00<00:00, 81.72it/s]
100%|      | 30/30 [00:00<00:00, 87.23it/s]
100%|      | 30/30 [00:00<00:00, 88.17it/s]
100%|      | 30/30 [00:00<00:00, 101.48it/s]
100%|      | 30/30 [00:00<00:00, 85.94it/s]
100%|      | 30/30 [00:00<00:00, 80.83it/s]
100%|      | 30/30 [00:00<00:00, 78.71it/s]
100%|      | 30/30 [00:00<00:00, 89.87it/s]
100%|      | 30/30 [00:00<00:00, 81.67it/s]
100%|      | 30/30 [00:00<00:00, 83.64it/s]
100%|      | 30/30 [00:00<00:00, 93.12it/s]
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100%|      | 30/30 [00:00<00:00, 90.30it/s]
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100%|      | 30/30 [00:00<00:00, 87.67it/s]
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100%|      | 30/30 [00:00<00:00, 76.65it/s]
100%|      | 30/30 [00:00<00:00, 94.62it/s]
100%|      | 30/30 [00:00<00:00, 88.41it/s]
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100%|      | 30/30 [00:00<00:00, 83.87it/s]
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100%|      | 30/30 [00:00<00:00, 82.64it/s]
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100%|      | 30/30 [00:00<00:00, 94.54it/s]
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100%|      | 30/30 [00:00<00:00, 98.62it/s]
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100%|      | 30/30 [00:00<00:00, 86.23it/s]
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100%|      | 30/30 [00:00<00:00, 81.15it/s]
100%|      | 30/30 [00:00<00:00, 89.52it/s]
```

```
Epoch 1/5
12/12 [==============================] - 11s 943ms/step - loss: 0.6885 -
accuracy: 0.6890
Epoch 2/5
12/12 [==============================] - 11s 940ms/step - loss: 0.6505 -
accuracy: 0.6837
Epoch 3/5
12/12 [==============================] - 11s 940ms/step - loss: 0.6513 -
accuracy: 0.6840
Epoch 4/5
12/12 [==============================] - 11s 942ms/step - loss: 0.6266 -
accuracy: 0.6917
Epoch 5/5
12/12 [==============================] - 11s 941ms/step - loss: 0.6193 -
accuracy: 0.7080
4/4 [==============================] - 1s 299ms/step - loss: 0.5275 - accuracy:
0.7467
```

```
100%|      | 30/30 [00:08<00:00,  3.42it/s]
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100%|      | 30/30 [00:08<00:00,  3.49it/s]
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100%|      | 30/30 [00:08<00:00,  3.52it/s]
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100%|      | 30/30 [00:08<00:00,  3.47it/s]
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100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]

Epoch 1/5
12/12 [==============================] - 11s 936ms/step - loss: 0.2862 -
accuracy: 0.9673
```

```
Epoch 2/5
12/12 [==============================] - 11s 937ms/step - loss: 0.2045 -
accuracy: 0.9673
Epoch 3/5
12/12 [==============================] - 11s 937ms/step - loss: 0.1487 -
accuracy: 0.9650
Epoch 4/5
12/12 [==============================] - 11s 931ms/step - loss: 0.1253 -
accuracy: 0.9653
Epoch 5/5
12/12 [==============================] - 11s 933ms/step - loss: 0.1488 -
accuracy: 0.9617
4/4 [==============================] - 1s 300ms/step - loss: 0.4808 - accuracy:
0.8244

100%|      | 30/30 [00:00<00:00, 85.51it/s]
100%|      | 30/30 [00:00<00:00, 91.75it/s]
100%|      | 30/30 [00:00<00:00, 99.04it/s]
100%|      | 30/30 [00:00<00:00, 100.12it/s]
100%|      | 30/30 [00:00<00:00, 98.63it/s]
100%|      | 30/30 [00:00<00:00, 95.98it/s]
100%|      | 30/30 [00:00<00:00, 85.37it/s]
100%|      | 30/30 [00:00<00:00, 101.72it/s]
100%|      | 30/30 [00:00<00:00, 88.64it/s]
100%|      | 30/30 [00:00<00:00, 98.12it/s]
100%|      | 30/30 [00:00<00:00, 81.47it/s]
100%|      | 30/30 [00:00<00:00, 86.62it/s]
100%|      | 30/30 [00:00<00:00, 85.32it/s]
100%|      | 30/30 [00:00<00:00, 93.16it/s]
100%|      | 30/30 [00:00<00:00, 90.30it/s]
100%|      | 30/30 [00:00<00:00, 97.79it/s]
100%|      | 30/30 [00:00<00:00, 94.39it/s]
100%|      | 30/30 [00:00<00:00, 94.37it/s]
100%|      | 30/30 [00:00<00:00, 90.25it/s]
100%|      | 30/30 [00:00<00:00, 86.27it/s]
100%|      | 30/30 [00:00<00:00, 92.03it/s]
100%|      | 30/30 [00:00<00:00, 88.48it/s]
100%|      | 30/30 [00:00<00:00, 93.58it/s]
100%|      | 30/30 [00:00<00:00, 91.64it/s]
100%|      | 30/30 [00:00<00:00, 82.50it/s]
100%|      | 30/30 [00:00<00:00, 90.46it/s]
100%|      | 30/30 [00:00<00:00, 80.58it/s]
100%|      | 30/30 [00:00<00:00, 87.09it/s]
100%|      | 30/30 [00:00<00:00, 99.89it/s]
100%|      | 30/30 [00:00<00:00, 97.81it/s]
100%|      | 30/30 [00:00<00:00, 84.29it/s]
100%|      | 30/30 [00:00<00:00, 85.19it/s]
100%|      | 30/30 [00:00<00:00, 77.41it/s]
```

```
100%|      | 30/30 [00:00<00:00, 90.81it/s]
100%|      | 30/30 [00:00<00:00, 90.63it/s]
100%|      | 30/30 [00:00<00:00, 80.50it/s]
100%|      | 30/30 [00:00<00:00, 91.47it/s]
100%|      | 30/30 [00:00<00:00, 101.56it/s]
100%|      | 30/30 [00:00<00:00, 91.20it/s]
100%|      | 30/30 [00:00<00:00, 91.30it/s]
100%|      | 30/30 [00:00<00:00, 93.76it/s]
100%|      | 30/30 [00:00<00:00, 82.75it/s]
100%|      | 30/30 [00:00<00:00, 93.25it/s]
100%|      | 30/30 [00:00<00:00, 85.72it/s]
100%|      | 30/30 [00:00<00:00, 92.16it/s]
100%|      | 30/30 [00:00<00:00, 93.84it/s]
100%|      | 30/30 [00:00<00:00, 102.63it/s]
100%|      | 30/30 [00:00<00:00, 94.51it/s]
100%|      | 30/30 [00:00<00:00, 103.06it/s]
100%|      | 30/30 [00:00<00:00, 98.71it/s]
100%|      | 30/30 [00:00<00:00, 82.03it/s]
100%|      | 30/30 [00:00<00:00, 81.47it/s]
100%|      | 30/30 [00:00<00:00, 90.59it/s]
100%|      | 30/30 [00:00<00:00, 93.95it/s]
100%|      | 30/30 [00:00<00:00, 91.19it/s]
100%|      | 30/30 [00:00<00:00, 82.31it/s]
100%|      | 30/30 [00:00<00:00, 80.01it/s]
100%|      | 30/30 [00:00<00:00, 101.48it/s]
100%|      | 30/30 [00:00<00:00, 102.07it/s]
100%|      | 30/30 [00:00<00:00, 83.48it/s]
100%|      | 30/30 [00:00<00:00, 101.25it/s]
100%|      | 30/30 [00:00<00:00, 96.22it/s]
100%|      | 30/30 [00:00<00:00, 89.49it/s]
100%|      | 30/30 [00:00<00:00, 91.34it/s]
100%|      | 30/30 [00:00<00:00, 92.94it/s]
100%|      | 30/30 [00:00<00:00, 90.15it/s]
100%|      | 30/30 [00:00<00:00, 98.84it/s]
100%|      | 30/30 [00:00<00:00, 99.53it/s]
100%|      | 30/30 [00:00<00:00, 91.25it/s]
100%|      | 30/30 [00:00<00:00, 102.57it/s]
100%|      | 30/30 [00:00<00:00, 102.08it/s]
100%|      | 30/30 [00:00<00:00, 92.39it/s]
100%|      | 30/30 [00:00<00:00, 93.50it/s]
100%|      | 30/30 [00:00<00:00, 102.94it/s]
100%|      | 30/30 [00:00<00:00, 80.39it/s]
100%|      | 30/30 [00:00<00:00, 91.82it/s]
100%|      | 30/30 [00:00<00:00, 89.12it/s]
100%|      | 30/30 [00:00<00:00, 84.51it/s]
100%|      | 30/30 [00:00<00:00, 91.37it/s]
100%|      | 30/30 [00:00<00:00, 88.33it/s]
100%|      | 30/30 [00:00<00:00, 92.43it/s]
```

```
100%|      | 30/30 [00:00<00:00, 96.23it/s]
100%|      | 30/30 [00:00<00:00, 99.11it/s]
100%|      | 30/30 [00:00<00:00, 92.01it/s]
100%|      | 30/30 [00:00<00:00, 88.12it/s]
100%|      | 30/30 [00:00<00:00, 90.48it/s]
100%|      | 30/30 [00:00<00:00, 96.00it/s]
100%|      | 30/30 [00:00<00:00, 90.93it/s]
100%|      | 30/30 [00:00<00:00, 87.02it/s]
100%|      | 30/30 [00:00<00:00, 86.11it/s]
100%|      | 30/30 [00:00<00:00, 93.15it/s]
100%|      | 30/30 [00:00<00:00, 95.16it/s]
100%|      | 30/30 [00:00<00:00, 83.56it/s]
100%|      | 30/30 [00:00<00:00, 101.66it/s]
100%|      | 30/30 [00:00<00:00, 87.30it/s]
100%|      | 30/30 [00:00<00:00, 102.16it/s]
100%|      | 30/30 [00:00<00:00, 97.42it/s]
100%|      | 30/30 [00:00<00:00, 93.32it/s]
100%|      | 30/30 [00:00<00:00, 95.85it/s]

Epoch 1/5
12/12 [==============================] - 11s 935ms/step - loss: 1.4236 -
accuracy: 0.5620
Epoch 2/5
12/12 [==============================] - 11s 931ms/step - loss: 0.8372 -
accuracy: 0.6727
Epoch 3/5
12/12 [==============================] - 11s 936ms/step - loss: 0.6405 -
accuracy: 0.6793
Epoch 4/5
12/12 [==============================] - 11s 932ms/step - loss: 0.5388 -
accuracy: 0.7230
Epoch 5/5
12/12 [==============================] - 11s 936ms/step - loss: 0.4927 -
accuracy: 0.7500
4/4 [==============================] - 1s 298ms/step - loss: 0.4882 - accuracy:
0.7578

100%|      | 30/30 [00:03<00:00,  7.62it/s]
100%|      | 30/30 [00:04<00:00,  7.34it/s]
100%|      | 30/30 [00:04<00:00,  7.42it/s]
100%|      | 30/30 [00:04<00:00,  7.42it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.37it/s]
100%|      | 30/30 [00:04<00:00,  7.31it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:04<00:00,  7.36it/s]
100%|      | 30/30 [00:04<00:00,  7.35it/s]
100%|      | 30/30 [00:03<00:00,  7.66it/s]
```

```
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:04<00:00,  7.26it/s]
100%|      | 30/30 [00:04<00:00,  7.34it/s]
100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:03<00:00,  7.57it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:03<00:00,  7.50it/s]
100%|      | 30/30 [00:04<00:00,  7.26it/s]
100%|      | 30/30 [00:04<00:00,  7.28it/s]
100%|      | 30/30 [00:04<00:00,  7.37it/s]
100%|      | 30/30 [00:04<00:00,  7.21it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:04<00:00,  7.36it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:04<00:00,  7.24it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:03<00:00,  7.50it/s]
100%|      | 30/30 [00:04<00:00,  7.35it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:04<00:00,  7.31it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:03<00:00,  7.67it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:04<00:00,  7.24it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
```

```
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.38it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:04<00:00,  7.37it/s]
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:04<00:00,  7.35it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:04<00:00,  7.42it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:04<00:00,  7.24it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:04<00:00,  7.27it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:03<00:00,  7.71it/s]
100%|      | 30/30 [00:03<00:00,  7.56it/s]
100%|      | 30/30 [00:03<00:00,  7.53it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:04<00:00,  7.43it/s]
100%|      | 30/30 [00:03<00:00,  7.68it/s]
100%|      | 30/30 [00:04<00:00,  7.50it/s]

Epoch 1/5
12/12 [==============================] - 11s 938ms/step - loss: 0.4051 -
accuracy: 0.8137
Epoch 2/5
12/12 [==============================] - 11s 932ms/step - loss: 0.4247 -
accuracy: 0.8130
Epoch 3/5
12/12 [==============================] - 11s 932ms/step - loss: 0.3782 -
```

```
accuracy: 0.8313
Epoch 4/5
12/12 [==============================] - 11s 941ms/step - loss: 0.3573 -
accuracy: 0.8473
Epoch 5/5
12/12 [==============================] - 11s 937ms/step - loss: 0.3238 -
accuracy: 0.8707
4/4 [==============================] - 1s 300ms/step - loss: 0.3492 - accuracy:
0.8744
Accuracy - None::  0.3311111032962799
Accuracy - jitter::  0.3311111032962799
Accuracy - scaling::  0.5188888907432556
Accuracy - rotation::  0.5144444704055786
Accuracy - permutation::  0.4444444477558136
Accuracy - magnitude_warp::  0.4033333361148834
Accuracy - time_warp::  0.551111102104187
Accuracy - window_slice::  0.6166666746139526
Accuracy - window_warp::  0.6744444370269775
Accuracy - spawner::  0.746666669845581
Accuracy - wdba::  0.8244444727897644
Accuracy - random_guided_warp::  0.757777750492096
Accuracy - discriminative_guided_warp::  0.8744444251060486
```

blstm1

[ ]:
```
model = get_model("blstm1", input_shape, nb_class)
model.compile(optimizer=optm, loss='categorical_crossentropy',␣
 ↪metrics=['accuracy'])
method_apply_deep(model, x_train, y_train, x_test, y_test)
```

```
Model: "model_4"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_5 (InputLayer)        [(None, 128, 1)]          0

 bidirectional (Bidirectiona  (None, 200)              81600
 l)

 dense_6 (Dense)             (None, 3)                 603

=================================================================
Total params: 82,203
Trainable params: 82,203
Non-trainable params: 0
_________________________________________________________________
Epoch 1/5
1/1 [==============================] - 4s 4s/step - loss: 1.1013 - accuracy:
```

```
0.4000
Epoch 2/5
1/1 [==============================] - 0s 141ms/step - loss: 1.1012 - accuracy:
0.4000
Epoch 3/5
1/1 [==============================] - 0s 138ms/step - loss: 1.1009 - accuracy:
0.4000
Epoch 4/5
1/1 [==============================] - 0s 161ms/step - loss: 1.1005 - accuracy:
0.4000
Epoch 5/5
1/1 [==============================] - 0s 140ms/step - loss: 1.1000 - accuracy:
0.4000
4/4 [==============================] - 2s 216ms/step - loss: 1.1043 - accuracy:
0.3278
Epoch 1/5
12/12 [==============================] - 11s 724ms/step - loss: 1.0955 -
accuracy: 0.4000
Epoch 2/5
12/12 [==============================] - 9s 721ms/step - loss: 1.0880 -
accuracy: 0.4000
Epoch 3/5
12/12 [==============================] - 9s 731ms/step - loss: 1.0839 -
accuracy: 0.4000
Epoch 4/5
12/12 [==============================] - 9s 731ms/step - loss: 1.0809 -
accuracy: 0.4000
Epoch 5/5
12/12 [==============================] - 9s 724ms/step - loss: 1.0785 -
accuracy: 0.4000
4/4 [==============================] - 1s 214ms/step - loss: 1.1072 - accuracy:
0.3311
Epoch 1/5
12/12 [==============================] - 9s 720ms/step - loss: 1.0759 -
accuracy: 0.4000
Epoch 2/5
12/12 [==============================] - 9s 729ms/step - loss: 1.0733 -
accuracy: 0.4000
Epoch 3/5
12/12 [==============================] - 9s 720ms/step - loss: 1.0707 -
accuracy: 0.4003
Epoch 4/5
12/12 [==============================] - 9s 733ms/step - loss: 1.0680 -
accuracy: 0.4023
Epoch 5/5
12/12 [==============================] - 9s 725ms/step - loss: 1.0652 -
accuracy: 0.4027
4/4 [==============================] - 1s 214ms/step - loss: 1.0920 - accuracy:
```

```
0.3511
Epoch 1/5
12/12 [==============================] - 9s 734ms/step - loss: 1.0914 -
accuracy: 0.4000
Epoch 2/5
12/12 [==============================] - 9s 724ms/step - loss: 1.0889 -
accuracy: 0.4473
Epoch 3/5
12/12 [==============================] - 9s 731ms/step - loss: 1.0860 -
accuracy: 0.5220
Epoch 4/5
12/12 [==============================] - 9s 732ms/step - loss: 1.0847 -
accuracy: 0.5123
Epoch 5/5
12/12 [==============================] - 9s 728ms/step - loss: 1.0840 -
accuracy: 0.4913
4/4 [==============================] - 1s 213ms/step - loss: 1.1026 - accuracy:
0.5167

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Epoch 1/5
12/12 [==============================] - 9s 741ms/step - loss: 1.0854 -
accuracy: 0.4823
Epoch 2/5
12/12 [==============================] - 9s 731ms/step - loss: 1.0846 -
accuracy: 0.4547
Epoch 3/5
12/12 [==============================] - 9s 724ms/step - loss: 1.0841 -
accuracy: 0.4000
Epoch 4/5
12/12 [==============================] - 9s 728ms/step - loss: 1.0839 -
accuracy: 0.4000
Epoch 5/5
12/12 [==============================] - 9s 725ms/step - loss: 1.0839 -
accuracy: 0.4000
4/4 [==============================] - 1s 213ms/step - loss: 1.0983 - accuracy:
0.3367
Epoch 1/5
12/12 [==============================] - 9s 736ms/step - loss: 1.0695 -
```

```
accuracy: 0.4080
Epoch 2/5
12/12 [==============================] - 9s 733ms/step - loss: 1.0676 -
accuracy: 0.4090
Epoch 3/5
12/12 [==============================] - 9s 734ms/step - loss: 1.0651 -
accuracy: 0.4107
Epoch 4/5
12/12 [==============================] - 9s 728ms/step - loss: 1.0622 -
accuracy: 0.4293
Epoch 5/5
12/12 [==============================] - 9s 720ms/step - loss: 1.0592 -
accuracy: 0.4607
4/4 [==============================] - 1s 215ms/step - loss: 1.0851 - accuracy:
0.4411
Epoch 1/5
12/12 [==============================] - 9s 725ms/step - loss: 1.0559 -
accuracy: 0.4590
Epoch 2/5
12/12 [==============================] - 9s 729ms/step - loss: 1.0522 -
accuracy: 0.4973
Epoch 3/5
12/12 [==============================] - 9s 724ms/step - loss: 1.0482 -
accuracy: 0.5000
Epoch 4/5
12/12 [==============================] - 9s 726ms/step - loss: 1.0436 -
accuracy: 0.5213
Epoch 5/5
12/12 [==============================] - 9s 723ms/step - loss: 1.0383 -
accuracy: 0.5743
4/4 [==============================] - 1s 215ms/step - loss: 1.0638 - accuracy:
0.5144
Epoch 1/5
12/12 [==============================] - 9s 724ms/step - loss: 1.0238 -
accuracy: 0.5273
Epoch 2/5
12/12 [==============================] - 9s 731ms/step - loss: 1.0148 -
accuracy: 0.5823
Epoch 3/5
12/12 [==============================] - 9s 723ms/step - loss: 1.0039 -
accuracy: 0.5983
Epoch 4/5
12/12 [==============================] - 9s 726ms/step - loss: 0.9906 -
accuracy: 0.5977
Epoch 5/5
12/12 [==============================] - 9s 727ms/step - loss: 0.9736 -
accuracy: 0.6003
4/4 [==============================] - 1s 211ms/step - loss: 1.0033 - accuracy:
```

```
0.4867
Epoch 1/5
12/12 [==============================] - 9s 721ms/step - loss: 0.9650 -
accuracy: 0.5983
Epoch 2/5
12/12 [==============================] - 9s 715ms/step - loss: 0.9390 -
accuracy: 0.7040
Epoch 3/5
12/12 [==============================] - 9s 729ms/step - loss: 0.9099 -
accuracy: 0.7183
Epoch 4/5
12/12 [==============================] - 9s 733ms/step - loss: 0.8777 -
accuracy: 0.7167
Epoch 5/5
12/12 [==============================] - 9s 736ms/step - loss: 0.8428 -
accuracy: 0.7133
4/4 [==============================] - 1s 212ms/step - loss: 0.8290 - accuracy:
0.7156

100%|      | 30/30 [00:00<00:00, 83.20it/s]
100%|      | 30/30 [00:00<00:00, 98.62it/s]
100%|      | 30/30 [00:00<00:00, 103.48it/s]
100%|      | 30/30 [00:00<00:00, 93.09it/s]
100%|      | 30/30 [00:00<00:00, 97.96it/s]
100%|      | 30/30 [00:00<00:00, 94.96it/s]
100%|      | 30/30 [00:00<00:00, 95.58it/s]
100%|      | 30/30 [00:00<00:00, 89.02it/s]
100%|      | 30/30 [00:00<00:00, 93.23it/s]
100%|      | 30/30 [00:00<00:00, 91.79it/s]
100%|      | 30/30 [00:00<00:00, 87.46it/s]
100%|      | 30/30 [00:00<00:00, 100.82it/s]
100%|      | 30/30 [00:00<00:00, 89.47it/s]
100%|      | 30/30 [00:00<00:00, 89.21it/s]
100%|      | 30/30 [00:00<00:00, 90.70it/s]
100%|      | 30/30 [00:00<00:00, 90.68it/s]
100%|      | 30/30 [00:00<00:00, 80.22it/s]
100%|      | 30/30 [00:00<00:00, 95.57it/s]
100%|      | 30/30 [00:00<00:00, 89.31it/s]
100%|      | 30/30 [00:00<00:00, 84.49it/s]
100%|      | 30/30 [00:00<00:00, 95.50it/s]
100%|      | 30/30 [00:00<00:00, 77.17it/s]
100%|      | 30/30 [00:00<00:00, 80.28it/s]
100%|      | 30/30 [00:00<00:00, 80.55it/s]
100%|      | 30/30 [00:00<00:00, 95.44it/s]
100%|      | 30/30 [00:00<00:00, 90.50it/s]
100%|      | 30/30 [00:00<00:00, 96.65it/s]
100%|      | 30/30 [00:00<00:00, 93.98it/s]
100%|      | 30/30 [00:00<00:00, 85.23it/s]
```

```
100%|      | 30/30 [00:00<00:00, 94.22it/s]
100%|      | 30/30 [00:00<00:00, 86.00it/s]
100%|      | 30/30 [00:00<00:00, 97.41it/s]
100%|      | 30/30 [00:00<00:00, 103.55it/s]
100%|      | 30/30 [00:00<00:00, 87.62it/s]
100%|      | 30/30 [00:00<00:00, 86.66it/s]
100%|      | 30/30 [00:00<00:00, 99.06it/s]
100%|      | 30/30 [00:00<00:00, 82.88it/s]
100%|      | 30/30 [00:00<00:00, 85.35it/s]
100%|      | 30/30 [00:00<00:00, 98.15it/s]
100%|      | 30/30 [00:00<00:00, 91.16it/s]
100%|      | 30/30 [00:00<00:00, 98.92it/s]
100%|      | 30/30 [00:00<00:00, 102.18it/s]
100%|      | 30/30 [00:00<00:00, 102.25it/s]
100%|      | 30/30 [00:00<00:00, 98.69it/s]
100%|      | 30/30 [00:00<00:00, 105.09it/s]
100%|      | 30/30 [00:00<00:00, 96.34it/s]
100%|      | 30/30 [00:00<00:00, 88.10it/s]
100%|      | 30/30 [00:00<00:00, 86.71it/s]
100%|      | 30/30 [00:00<00:00, 87.62it/s]
100%|      | 30/30 [00:00<00:00, 92.15it/s]
100%|      | 30/30 [00:00<00:00, 99.39it/s]
100%|      | 30/30 [00:00<00:00, 91.66it/s]
100%|      | 30/30 [00:00<00:00, 95.75it/s]
100%|      | 30/30 [00:00<00:00, 99.98it/s]
100%|      | 30/30 [00:00<00:00, 99.91it/s]
100%|      | 30/30 [00:00<00:00, 92.52it/s]
100%|      | 30/30 [00:00<00:00, 104.86it/s]
100%|      | 30/30 [00:00<00:00, 90.87it/s]
100%|      | 30/30 [00:00<00:00, 76.38it/s]
100%|      | 30/30 [00:00<00:00, 97.29it/s]
100%|      | 30/30 [00:00<00:00, 101.66it/s]
100%|      | 30/30 [00:00<00:00, 86.52it/s]
100%|      | 30/30 [00:00<00:00, 103.24it/s]
100%|      | 30/30 [00:00<00:00, 96.87it/s]
100%|      | 30/30 [00:00<00:00, 91.12it/s]
100%|      | 30/30 [00:00<00:00, 98.89it/s]
100%|      | 30/30 [00:00<00:00, 98.74it/s]
100%|      | 30/30 [00:00<00:00, 99.07it/s]
100%|      | 30/30 [00:00<00:00, 98.23it/s]
100%|      | 30/30 [00:00<00:00, 93.77it/s]
100%|      | 30/30 [00:00<00:00, 94.67it/s]
100%|      | 30/30 [00:00<00:00, 92.79it/s]
100%|      | 30/30 [00:00<00:00, 91.69it/s]
100%|      | 30/30 [00:00<00:00, 85.78it/s]
100%|      | 30/30 [00:00<00:00, 94.09it/s]
100%|      | 30/30 [00:00<00:00, 95.65it/s]
100%|      | 30/30 [00:00<00:00, 80.76it/s]
```

```
100%|      | 30/30 [00:00<00:00, 78.75it/s]
100%|      | 30/30 [00:00<00:00, 73.50it/s]
100%|      | 30/30 [00:00<00:00, 78.86it/s]
100%|      | 30/30 [00:00<00:00, 86.96it/s]
100%|      | 30/30 [00:00<00:00, 84.81it/s]
100%|      | 30/30 [00:00<00:00, 82.97it/s]
100%|      | 30/30 [00:00<00:00, 94.69it/s]
100%|      | 30/30 [00:00<00:00, 86.60it/s]
100%|      | 30/30 [00:00<00:00, 96.20it/s]
100%|      | 30/30 [00:00<00:00, 100.20it/s]
100%|      | 30/30 [00:00<00:00, 87.13it/s]
100%|      | 30/30 [00:00<00:00, 93.20it/s]
100%|      | 30/30 [00:00<00:00, 102.61it/s]
100%|      | 30/30 [00:00<00:00, 80.45it/s]
100%|      | 30/30 [00:00<00:00, 95.14it/s]
100%|      | 30/30 [00:00<00:00, 100.39it/s]
100%|      | 30/30 [00:00<00:00, 86.55it/s]
100%|      | 30/30 [00:00<00:00, 85.11it/s]
100%|      | 30/30 [00:00<00:00, 80.62it/s]
100%|      | 30/30 [00:00<00:00, 87.64it/s]
100%|      | 30/30 [00:00<00:00, 99.34it/s]
100%|      | 30/30 [00:00<00:00, 92.81it/s]
```

```
Epoch 1/5
12/12 [==============================] - 9s 728ms/step - loss: 0.8221 -
accuracy: 0.7347
Epoch 2/5
12/12 [==============================] - 9s 738ms/step - loss: 0.7820 -
accuracy: 0.6953
Epoch 3/5
12/12 [==============================] - 9s 728ms/step - loss: 0.7458 -
accuracy: 0.6940
Epoch 4/5
12/12 [==============================] - 9s 723ms/step - loss: 0.7056 -
accuracy: 0.6973
Epoch 5/5
12/12 [==============================] - 9s 724ms/step - loss: 0.6595 -
accuracy: 0.7110
4/4 [==============================] - 1s 219ms/step - loss: 0.6191 - accuracy:
0.6989
```

```
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.45it/s]
```

```
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.57it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.41it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.45it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.41it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
```

```
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.59it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.51it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.54it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.44it/s]
100%|      | 30/30 [00:08<00:00,  3.49it/s]
100%|      | 30/30 [00:08<00:00,  3.46it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]

Epoch 1/5
12/12 [==============================] - 9s 747ms/step - loss: 0.3974 -
accuracy: 0.9490
Epoch 2/5
```

```
12/12 [==============================] - 9s 721ms/step - loss: 0.3322 -
accuracy: 0.9483
Epoch 3/5
12/12 [==============================] - 9s 731ms/step - loss: 0.2739 -
accuracy: 0.9523
Epoch 4/5
12/12 [==============================] - 9s 746ms/step - loss: 0.2426 -
accuracy: 0.9503
Epoch 5/5
12/12 [==============================] - 9s 774ms/step - loss: 0.2476 -
accuracy: 0.9413
4/4 [==============================] - 1s 216ms/step - loss: 0.5019 - accuracy:
0.7667

100%|      | 30/30 [00:00<00:00, 75.99it/s]
100%|      | 30/30 [00:00<00:00, 81.45it/s]
100%|      | 30/30 [00:00<00:00, 80.50it/s]
100%|      | 30/30 [00:00<00:00, 83.02it/s]
100%|      | 30/30 [00:00<00:00, 79.65it/s]
100%|      | 30/30 [00:00<00:00, 86.04it/s]
100%|      | 30/30 [00:00<00:00, 75.72it/s]
100%|      | 30/30 [00:00<00:00, 84.80it/s]
100%|      | 30/30 [00:00<00:00, 85.84it/s]
100%|      | 30/30 [00:00<00:00, 77.51it/s]
100%|      | 30/30 [00:00<00:00, 89.53it/s]
100%|      | 30/30 [00:00<00:00, 87.40it/s]
100%|      | 30/30 [00:00<00:00, 70.43it/s]
100%|      | 30/30 [00:00<00:00, 75.06it/s]
100%|      | 30/30 [00:00<00:00, 73.12it/s]
100%|      | 30/30 [00:00<00:00, 79.76it/s]
100%|      | 30/30 [00:00<00:00, 73.70it/s]
100%|      | 30/30 [00:00<00:00, 79.22it/s]
100%|      | 30/30 [00:00<00:00, 83.07it/s]
100%|      | 30/30 [00:00<00:00, 85.05it/s]
100%|      | 30/30 [00:00<00:00, 90.64it/s]
100%|      | 30/30 [00:00<00:00, 84.70it/s]
100%|      | 30/30 [00:00<00:00, 87.23it/s]
100%|      | 30/30 [00:00<00:00, 85.58it/s]
100%|      | 30/30 [00:00<00:00, 90.18it/s]
100%|      | 30/30 [00:00<00:00, 95.64it/s]
100%|      | 30/30 [00:00<00:00, 78.54it/s]
100%|      | 30/30 [00:00<00:00, 86.92it/s]
100%|      | 30/30 [00:00<00:00, 93.49it/s]
100%|      | 30/30 [00:00<00:00, 93.78it/s]
100%|      | 30/30 [00:00<00:00, 85.09it/s]
100%|      | 30/30 [00:00<00:00, 80.09it/s]
100%|      | 30/30 [00:00<00:00, 84.63it/s]
100%|      | 30/30 [00:00<00:00, 86.55it/s]
```

```
100%|      | 30/30 [00:00<00:00, 76.61it/s]
100%|      | 30/30 [00:00<00:00, 80.67it/s]
100%|      | 30/30 [00:00<00:00, 78.48it/s]
100%|      | 30/30 [00:00<00:00, 89.99it/s]
100%|      | 30/30 [00:00<00:00, 88.16it/s]
100%|      | 30/30 [00:00<00:00, 87.02it/s]
100%|      | 30/30 [00:00<00:00, 84.40it/s]
100%|      | 30/30 [00:00<00:00, 91.60it/s]
100%|      | 30/30 [00:00<00:00, 86.82it/s]
100%|      | 30/30 [00:00<00:00, 90.21it/s]
100%|      | 30/30 [00:00<00:00, 81.80it/s]
100%|      | 30/30 [00:00<00:00, 88.39it/s]
100%|      | 30/30 [00:00<00:00, 73.93it/s]
100%|      | 30/30 [00:00<00:00, 90.46it/s]
100%|      | 30/30 [00:00<00:00, 80.85it/s]
100%|      | 30/30 [00:00<00:00, 79.18it/s]
100%|      | 30/30 [00:00<00:00, 79.96it/s]
100%|      | 30/30 [00:00<00:00, 93.60it/s]
100%|      | 30/30 [00:00<00:00, 87.27it/s]
100%|      | 30/30 [00:00<00:00, 90.18it/s]
100%|      | 30/30 [00:00<00:00, 81.66it/s]
100%|      | 30/30 [00:00<00:00, 73.63it/s]
100%|      | 30/30 [00:00<00:00, 95.66it/s]
100%|      | 30/30 [00:00<00:00, 101.53it/s]
100%|      | 30/30 [00:00<00:00, 91.85it/s]
100%|      | 30/30 [00:00<00:00, 95.21it/s]
100%|      | 30/30 [00:00<00:00, 83.99it/s]
100%|      | 30/30 [00:00<00:00, 90.37it/s]
100%|      | 30/30 [00:00<00:00, 86.20it/s]
100%|      | 30/30 [00:00<00:00, 84.26it/s]
100%|      | 30/30 [00:00<00:00, 90.45it/s]
100%|      | 30/30 [00:00<00:00, 97.79it/s]
100%|      | 30/30 [00:00<00:00, 98.33it/s]
100%|      | 30/30 [00:00<00:00, 79.16it/s]
100%|      | 30/30 [00:00<00:00, 100.49it/s]
100%|      | 30/30 [00:00<00:00, 102.36it/s]
100%|      | 30/30 [00:00<00:00, 81.82it/s]
100%|      | 30/30 [00:00<00:00, 97.59it/s]
100%|      | 30/30 [00:00<00:00, 85.56it/s]
100%|      | 30/30 [00:00<00:00, 94.28it/s]
100%|      | 30/30 [00:00<00:00, 89.99it/s]
100%|      | 30/30 [00:00<00:00, 76.31it/s]
100%|      | 30/30 [00:00<00:00, 88.70it/s]
100%|      | 30/30 [00:00<00:00, 81.55it/s]
100%|      | 30/30 [00:00<00:00, 85.69it/s]
100%|      | 30/30 [00:00<00:00, 89.04it/s]
100%|      | 30/30 [00:00<00:00, 95.57it/s]
100%|      | 30/30 [00:00<00:00, 77.07it/s]
```

```
100%|      | 30/30 [00:00<00:00, 89.35it/s]
100%|      | 30/30 [00:00<00:00, 77.10it/s]
100%|      | 30/30 [00:00<00:00, 87.91it/s]
100%|      | 30/30 [00:00<00:00, 85.05it/s]
100%|      | 30/30 [00:00<00:00, 80.59it/s]
100%|      | 30/30 [00:00<00:00, 92.27it/s]
100%|      | 30/30 [00:00<00:00, 95.50it/s]
100%|      | 30/30 [00:00<00:00, 75.26it/s]
100%|      | 30/30 [00:00<00:00, 87.53it/s]
100%|      | 30/30 [00:00<00:00, 91.79it/s]
100%|      | 30/30 [00:00<00:00, 85.31it/s]
100%|      | 30/30 [00:00<00:00, 81.79it/s]
100%|      | 30/30 [00:00<00:00, 82.14it/s]
100%|      | 30/30 [00:00<00:00, 77.87it/s]
100%|      | 30/30 [00:00<00:00, 89.70it/s]
100%|      | 30/30 [00:00<00:00, 74.65it/s]
100%|      | 30/30 [00:00<00:00, 77.92it/s]

Epoch 1/5
12/12 [==============================] - 9s 775ms/step - loss: 1.0301 -
accuracy: 0.6353
Epoch 2/5
12/12 [==============================] - 9s 778ms/step - loss: 0.9278 -
accuracy: 0.6110
Epoch 3/5
12/12 [==============================] - 9s 752ms/step - loss: 0.6027 -
accuracy: 0.7380
Epoch 4/5
12/12 [==============================] - 9s 746ms/step - loss: 0.5543 -
accuracy: 0.7760
Epoch 5/5
12/12 [==============================] - 9s 739ms/step - loss: 0.5315 -
accuracy: 0.7770
4/4 [==============================] - 1s 214ms/step - loss: 0.5495 - accuracy:
0.7456

100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:04<00:00,  7.22it/s]
100%|      | 30/30 [00:04<00:00,  7.24it/s]
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:04<00:00,  7.38it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:04<00:00,  7.12it/s]
100%|      | 30/30 [00:04<00:00,  7.31it/s]
100%|      | 30/30 [00:04<00:00,  7.35it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:04<00:00,  7.34it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
```

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100%|      | 30/30 [00:04<00:00,  7.25it/s]
100%|      | 30/30 [00:04<00:00,  7.30it/s]
100%|      | 30/30 [00:03<00:00,  7.55it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
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100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:03<00:00,  7.60it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
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100%|      | 30/30 [00:04<00:00,  7.27it/s]
100%|      | 30/30 [00:04<00:00,  7.14it/s]
100%|      | 30/30 [00:04<00:00,  7.29it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:04<00:00,  7.21it/s]
100%|      | 30/30 [00:04<00:00,  7.28it/s]
100%|      | 30/30 [00:04<00:00,  7.05it/s]
100%|      | 30/30 [00:04<00:00,  7.18it/s]
100%|      | 30/30 [00:04<00:00,  7.32it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
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100%|      | 30/30 [00:03<00:00,  7.52it/s]
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100%|      | 30/30 [00:04<00:00,  7.31it/s]
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100%|      | 30/30 [00:04<00:00,  7.03it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:04<00:00,  7.30it/s]
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.27it/s]
100%|      | 30/30 [00:04<00:00,  7.27it/s]
100%|      | 30/30 [00:04<00:00,  7.28it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.27it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:04<00:00,  7.15it/s]
100%|      | 30/30 [00:04<00:00,  7.25it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:04<00:00,  7.26it/s]
100%|      | 30/30 [00:04<00:00,  7.21it/s]
```

```
100%|      | 30/30 [00:04<00:00,  7.31it/s]
100%|      | 30/30 [00:04<00:00,  7.32it/s]
100%|      | 30/30 [00:04<00:00,  7.25it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:04<00:00,  7.32it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:04<00:00,  7.36it/s]
100%|      | 30/30 [00:04<00:00,  7.50it/s]
100%|      | 30/30 [00:04<00:00,  7.26it/s]
100%|      | 30/30 [00:04<00:00,  7.38it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:04<00:00,  7.48it/s]
100%|      | 30/30 [00:04<00:00,  7.31it/s]
100%|      | 30/30 [00:04<00:00,  7.34it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:04<00:00,  7.30it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:04<00:00,  7.22it/s]
100%|      | 30/30 [00:04<00:00,  7.30it/s]
100%|      | 30/30 [00:04<00:00,  7.35it/s]
100%|      | 30/30 [00:04<00:00,  7.30it/s]
100%|      | 30/30 [00:04<00:00,  7.15it/s]
100%|      | 30/30 [00:04<00:00,  7.38it/s]
100%|      | 30/30 [00:04<00:00,  7.27it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:04<00:00,  7.29it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
100%|      | 30/30 [00:04<00:00,  7.47it/s]
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:04<00:00,  7.50it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:03<00:00,  7.74it/s]
100%|      | 30/30 [00:04<00:00,  7.37it/s]
100%|      | 30/30 [00:04<00:00,  7.46it/s]
Epoch 1/5
12/12 [==============================] - 9s 732ms/step - loss: 0.4379 -
accuracy: 0.8427
Epoch 2/5
12/12 [==============================] - 9s 745ms/step - loss: 0.4153 -
accuracy: 0.8527
Epoch 3/5
12/12 [==============================] - 9s 732ms/step - loss: 0.3891 -
accuracy: 0.8547
```

```
Epoch 4/5
12/12 [==============================] - 9s 731ms/step - loss: 0.3640 -
accuracy: 0.8660
Epoch 5/5
12/12 [==============================] - 9s 731ms/step - loss: 0.3454 -
accuracy: 0.8667
4/4 [==============================] - 1s 217ms/step - loss: 0.4144 - accuracy:
0.8144
Accuracy - None::  0.32777777314186096
Accuracy - jitter::  0.3311111032962799
Accuracy - scaling::  0.35111111402511597
Accuracy - rotation::  0.5166666507720947
Accuracy - permutation::  0.33666667342185974
Accuracy - magnitude_warp::  0.44111111760139465
Accuracy - time_warp::  0.5144444704055786
Accuracy - window_slice::  0.4866666793823242
Accuracy - window_warp::  0.7155555486679077
Accuracy - spawner::  0.698888897895813
Accuracy - wdba::  0.7666666507720947
Accuracy - random_guided_warp::  0.745555579662323
Accuracy - discriminative_guided_warp::  0.8144444227218628
```

blstm2

[ ]:
```
model = get_model("blstm2", input_shape, nb_class)
model.compile(optimizer=optm, loss='categorical_crossentropy',␣
 ↪metrics=['accuracy'])
method_apply_deep(model, x_train, y_train, x_test, y_test)
```

```
Model: "model"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_1 (InputLayer)        [(None, 128, 1)]          0

 bidirectional (Bidirectiona  (None, 128, 200)         81600
 l)

 bidirectional_1 (Bidirectio  (None, 200)              240800
 nal)

 dense (Dense)               (None, 3)                 603

=================================================================
Total params: 323,003
Trainable params: 323,003
Non-trainable params: 0
_________________________________________________________________
```

```
Epoch 1/5
1/1 [==============================] - 8s 8s/step - loss: 1.0998 - accuracy:
0.3000
Epoch 2/5
1/1 [==============================] - 0s 466ms/step - loss: 1.0992 - accuracy:
0.3333
Epoch 3/5
1/1 [==============================] - 0s 453ms/step - loss: 1.0980 - accuracy:
0.3333
Epoch 4/5
1/1 [==============================] - 0s 471ms/step - loss: 1.0964 - accuracy:
0.3333
Epoch 5/5
1/1 [==============================] - 0s 455ms/step - loss: 1.0945 - accuracy:
0.3333
4/4 [==============================] - 4s 604ms/step - loss: 1.0957 - accuracy:
0.4211
Epoch 1/5
12/12 [==============================] - 31s 2s/step - loss: 1.0836 - accuracy:
0.4210
Epoch 2/5
12/12 [==============================] - 27s 2s/step - loss: 1.0752 - accuracy:
0.4000
Epoch 3/5
12/12 [==============================] - 29s 2s/step - loss: 1.0676 - accuracy:
0.4000
Epoch 4/5
12/12 [==============================] - 27s 2s/step - loss: 1.0578 - accuracy:
0.4027
Epoch 5/5
12/12 [==============================] - 25s 2s/step - loss: 1.0450 - accuracy:
0.4893
4/4 [==============================] - 2s 577ms/step - loss: 1.0606 - accuracy:
0.4800
Epoch 1/5
12/12 [==============================] - 25s 2s/step - loss: 1.0239 - accuracy:
0.5540
Epoch 2/5
12/12 [==============================] - 25s 2s/step - loss: 0.9827 - accuracy:
0.5897
Epoch 3/5
12/12 [==============================] - 26s 2s/step - loss: 0.8863 - accuracy:
0.7183
Epoch 4/5
12/12 [==============================] - 30s 3s/step - loss: 0.7646 - accuracy:
0.6680
Epoch 5/5
12/12 [==============================] - 28s 2s/step - loss: 0.6930 - accuracy:
```

```
0.6447
4/4 [==============================] - 2s 584ms/step - loss: 0.5868 - accuracy:
0.7622
Epoch 1/5
12/12 [==============================] - 26s 2s/step - loss: 1.3786 - accuracy:
0.4257
Epoch 2/5
12/12 [==============================] - 26s 2s/step - loss: 1.0382 - accuracy:
0.4487
Epoch 3/5
12/12 [==============================] - 26s 2s/step - loss: 0.9664 - accuracy:
0.4800
Epoch 4/5
12/12 [==============================] - 26s 2s/step - loss: 0.9152 - accuracy:
0.5297
Epoch 5/5
12/12 [==============================] - 27s 2s/step - loss: 0.8620 - accuracy:
0.5053
4/4 [==============================] - 3s 599ms/step - loss: 0.5353 - accuracy:
0.8122

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Epoch 1/5
12/12 [==============================] - 27s 2s/step - loss: 1.0085 - accuracy:
0.5197
Epoch 2/5
12/12 [==============================] - 28s 2s/step - loss: 0.8956 - accuracy:
0.5723
Epoch 3/5
12/12 [==============================] - 27s 2s/step - loss: 0.8591 - accuracy:
0.5983
Epoch 4/5
12/12 [==============================] - 26s 2s/step - loss: 0.8325 - accuracy:
0.6280
Epoch 5/5
12/12 [==============================] - 27s 2s/step - loss: 0.8108 - accuracy:
0.6250
4/4 [==============================] - 3s 599ms/step - loss: 0.5598 - accuracy:
0.7689
```

```
Epoch 1/5
12/12 [==============================] - 28s 2s/step - loss: 0.6617 - accuracy:
0.7163
Epoch 2/5
12/12 [==============================] - 26s 2s/step - loss: 0.4567 - accuracy:
0.8020
Epoch 3/5
12/12 [==============================] - 26s 2s/step - loss: 0.3570 - accuracy:
0.8477
Epoch 4/5
12/12 [==============================] - 26s 2s/step - loss: 0.2736 - accuracy:
0.9050
Epoch 5/5
12/12 [==============================] - 29s 2s/step - loss: 0.2090 - accuracy:
0.9327
4/4 [==============================] - 2s 595ms/step - loss: 0.1838 - accuracy:
0.9433
Epoch 1/5
12/12 [==============================] - 27s 2s/step - loss: 0.0865 - accuracy:
0.9820
Epoch 2/5
12/12 [==============================] - 27s 2s/step - loss: 0.0387 - accuracy:
0.9987
Epoch 3/5
12/12 [==============================] - 26s 2s/step - loss: 0.0209 - accuracy:
0.9990
Epoch 4/5
12/12 [==============================] - 27s 2s/step - loss: 0.0165 - accuracy:
0.9997
Epoch 5/5
12/12 [==============================] - 28s 2s/step - loss: 0.0138 - accuracy:
0.9993
4/4 [==============================] - 3s 599ms/step - loss: 0.1125 - accuracy:
0.9689
Epoch 1/5
12/12 [==============================] - 27s 2s/step - loss: 0.2151 - accuracy:
0.9483
Epoch 2/5
12/12 [==============================] - 28s 2s/step - loss: 1.2921 - accuracy:
0.6147
Epoch 3/5
12/12 [==============================] - 29s 2s/step - loss: 0.5321 - accuracy:
0.7787
Epoch 4/5
12/12 [==============================] - 28s 2s/step - loss: 0.2802 - accuracy:
0.9390
Epoch 5/5
12/12 [==============================] - 28s 2s/step - loss: 0.1184 - accuracy:
```

```
0.9800
4/4 [==============================] - 2s 590ms/step - loss: 0.3959 - accuracy:
0.9322
Epoch 1/5
12/12 [==============================] - 28s 2s/step - loss: 0.5279 - accuracy:
0.8413
Epoch 2/5
12/12 [==============================] - 27s 2s/step - loss: 0.1496 - accuracy:
0.9517
Epoch 3/5
12/12 [==============================] - 28s 2s/step - loss: 0.0627 - accuracy:
0.9907
Epoch 4/5
12/12 [==============================] - 27s 2s/step - loss: 0.0358 - accuracy:
0.9960
Epoch 5/5
12/12 [==============================] - 28s 2s/step - loss: 0.0299 - accuracy:
0.9963
4/4 [==============================] - 3s 597ms/step - loss: 0.0994 - accuracy:
0.9689
```

```
100%|      | 30/30 [00:00<00:00, 96.91it/s]
100%|      | 30/30 [00:00<00:00, 96.85it/s]
100%|      | 30/30 [00:00<00:00, 96.73it/s]
100%|      | 30/30 [00:00<00:00, 98.92it/s]
100%|      | 30/30 [00:00<00:00, 99.23it/s]
100%|      | 30/30 [00:00<00:00, 98.55it/s]
100%|      | 30/30 [00:00<00:00, 96.93it/s]
100%|      | 30/30 [00:00<00:00, 98.50it/s]
100%|      | 30/30 [00:00<00:00, 100.93it/s]
100%|      | 30/30 [00:00<00:00, 97.52it/s]
100%|      | 30/30 [00:00<00:00, 98.67it/s]
100%|      | 30/30 [00:00<00:00, 103.18it/s]
100%|      | 30/30 [00:00<00:00, 106.96it/s]
100%|      | 30/30 [00:00<00:00, 107.11it/s]
100%|      | 30/30 [00:00<00:00, 95.42it/s]
100%|      | 30/30 [00:00<00:00, 108.27it/s]
100%|      | 30/30 [00:00<00:00, 94.88it/s]
100%|      | 30/30 [00:00<00:00, 100.08it/s]
100%|      | 30/30 [00:00<00:00, 102.06it/s]
100%|      | 30/30 [00:00<00:00, 107.70it/s]
100%|      | 30/30 [00:00<00:00, 101.80it/s]
100%|      | 30/30 [00:00<00:00, 100.40it/s]
100%|      | 30/30 [00:00<00:00, 104.99it/s]
100%|      | 30/30 [00:00<00:00, 92.39it/s]
100%|      | 30/30 [00:00<00:00, 100.06it/s]
100%|      | 30/30 [00:00<00:00, 99.28it/s]
100%|      | 30/30 [00:00<00:00, 99.92it/s]
```

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100%|      | 30/30 [00:00<00:00, 103.91it/s]
100%|      | 30/30 [00:00<00:00, 105.73it/s]
100%|      | 30/30 [00:00<00:00, 108.23it/s]
100%|      | 30/30 [00:00<00:00, 98.68it/s]
100%|      | 30/30 [00:00<00:00, 106.58it/s]
100%|      | 30/30 [00:00<00:00, 105.26it/s]
100%|      | 30/30 [00:00<00:00, 105.40it/s]
100%|      | 30/30 [00:00<00:00, 97.44it/s]
100%|      | 30/30 [00:00<00:00, 102.34it/s]
100%|      | 30/30 [00:00<00:00, 95.19it/s]
100%|      | 30/30 [00:00<00:00, 100.58it/s]
100%|      | 30/30 [00:00<00:00, 98.06it/s]
100%|      | 30/30 [00:00<00:00, 100.44it/s]
100%|      | 30/30 [00:00<00:00, 97.13it/s]
100%|      | 30/30 [00:00<00:00, 105.50it/s]
100%|      | 30/30 [00:00<00:00, 101.13it/s]
100%|      | 30/30 [00:00<00:00, 96.03it/s]
100%|      | 30/30 [00:00<00:00, 102.04it/s]
100%|      | 30/30 [00:00<00:00, 96.39it/s]
100%|      | 30/30 [00:00<00:00, 95.75it/s]
100%|      | 30/30 [00:00<00:00, 105.94it/s]
100%|      | 30/30 [00:00<00:00, 102.72it/s]
100%|      | 30/30 [00:00<00:00, 94.38it/s]
100%|      | 30/30 [00:00<00:00, 97.74it/s]
100%|      | 30/30 [00:00<00:00, 99.72it/s]
100%|      | 30/30 [00:00<00:00, 106.37it/s]
100%|      | 30/30 [00:00<00:00, 104.85it/s]
100%|      | 30/30 [00:00<00:00, 104.56it/s]
100%|      | 30/30 [00:00<00:00, 110.90it/s]
100%|      | 30/30 [00:00<00:00, 101.69it/s]
100%|      | 30/30 [00:00<00:00, 99.32it/s]
100%|      | 30/30 [00:00<00:00, 99.86it/s]
100%|      | 30/30 [00:00<00:00, 99.37it/s]
100%|      | 30/30 [00:00<00:00, 105.12it/s]
100%|      | 30/30 [00:00<00:00, 103.33it/s]
100%|      | 30/30 [00:00<00:00, 100.20it/s]
100%|      | 30/30 [00:00<00:00, 104.67it/s]
100%|      | 30/30 [00:00<00:00, 102.06it/s]
100%|      | 30/30 [00:00<00:00, 103.06it/s]
100%|      | 30/30 [00:00<00:00, 102.64it/s]
100%|      | 30/30 [00:00<00:00, 104.02it/s]
100%|      | 30/30 [00:00<00:00, 100.12it/s]
100%|      | 30/30 [00:00<00:00, 101.48it/s]
100%|      | 30/30 [00:00<00:00, 104.71it/s]
100%|      | 30/30 [00:00<00:00, 109.53it/s]
100%|      | 30/30 [00:00<00:00, 106.62it/s]
100%|      | 30/30 [00:00<00:00, 100.28it/s]
100%|      | 30/30 [00:00<00:00, 93.91it/s]
```

```
100%|      | 30/30 [00:00<00:00, 109.80it/s]
100%|      | 30/30 [00:00<00:00, 109.54it/s]
100%|      | 30/30 [00:00<00:00, 99.14it/s]
100%|      | 30/30 [00:00<00:00, 100.83it/s]
100%|      | 30/30 [00:00<00:00, 101.06it/s]
100%|      | 30/30 [00:00<00:00, 101.18it/s]
100%|      | 30/30 [00:00<00:00, 94.99it/s]
100%|      | 30/30 [00:00<00:00, 106.63it/s]
100%|      | 30/30 [00:00<00:00, 101.73it/s]
100%|      | 30/30 [00:00<00:00, 100.83it/s]
100%|      | 30/30 [00:00<00:00, 101.11it/s]
100%|      | 30/30 [00:00<00:00, 96.70it/s]
100%|      | 30/30 [00:00<00:00, 94.66it/s]
100%|      | 30/30 [00:00<00:00, 102.36it/s]
100%|      | 30/30 [00:00<00:00, 97.02it/s]
100%|      | 30/30 [00:00<00:00, 101.08it/s]
100%|      | 30/30 [00:00<00:00, 107.10it/s]
100%|      | 30/30 [00:00<00:00, 107.21it/s]
100%|      | 30/30 [00:00<00:00, 104.78it/s]
100%|      | 30/30 [00:00<00:00, 95.48it/s]
100%|      | 30/30 [00:00<00:00, 90.70it/s]
100%|      | 30/30 [00:00<00:00, 103.48it/s]
100%|      | 30/30 [00:00<00:00, 106.75it/s]
100%|      | 30/30 [00:00<00:00, 95.81it/s]

Epoch 1/5
12/12 [==============================] - 27s 2s/step - loss: 0.8200 - accuracy:
0.7783
Epoch 2/5
12/12 [==============================] - 26s 2s/step - loss: 0.5634 - accuracy:
0.8160
Epoch 3/5
12/12 [==============================] - 25s 2s/step - loss: 0.4776 - accuracy:
0.8180
Epoch 4/5
12/12 [==============================] - 27s 2s/step - loss: 0.4348 - accuracy:
0.8257
Epoch 5/5
12/12 [==============================] - 27s 2s/step - loss: 0.4021 - accuracy:
0.8400
4/4 [==============================] - 2s 591ms/step - loss: 0.1438 - accuracy:
0.9878

100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:08<00:00,  3.70it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.75it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.90it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]

Epoch 1/5
12/12 [==============================] - 26s 2s/step - loss: 0.0606 - accuracy:
```

```
0.9997
Epoch 2/5
12/12 [==============================] - 25s 2s/step - loss: 0.0255 - accuracy:
0.9997
Epoch 3/5
12/12 [==============================] - 25s 2s/step - loss: 0.0166 - accuracy:
0.9997
Epoch 4/5
12/12 [==============================] - 25s 2s/step - loss: 0.0125 - accuracy:
0.9997
Epoch 5/5
12/12 [==============================] - 25s 2s/step - loss: 0.0105 - accuracy:
0.9997
4/4 [==============================] - 2s 580ms/step - loss: 0.0995 - accuracy:
0.9789

100%|      | 30/30 [00:00<00:00, 105.96it/s]
100%|      | 30/30 [00:00<00:00, 109.05it/s]
100%|      | 30/30 [00:00<00:00, 102.98it/s]
100%|      | 30/30 [00:00<00:00, 102.92it/s]
100%|      | 30/30 [00:00<00:00, 105.30it/s]
100%|      | 30/30 [00:00<00:00, 87.40it/s]
100%|      | 30/30 [00:00<00:00, 98.25it/s]
100%|      | 30/30 [00:00<00:00, 103.82it/s]
100%|      | 30/30 [00:00<00:00, 103.29it/s]
100%|      | 30/30 [00:00<00:00, 95.90it/s]
100%|      | 30/30 [00:00<00:00, 101.43it/s]
100%|      | 30/30 [00:00<00:00, 98.35it/s]
100%|      | 30/30 [00:00<00:00, 105.11it/s]
100%|      | 30/30 [00:00<00:00, 103.44it/s]
100%|      | 30/30 [00:00<00:00, 95.47it/s]
100%|      | 30/30 [00:00<00:00, 96.43it/s]
100%|      | 30/30 [00:00<00:00, 91.36it/s]
100%|      | 30/30 [00:00<00:00, 94.74it/s]
100%|      | 30/30 [00:00<00:00, 96.72it/s]
100%|      | 30/30 [00:00<00:00, 93.87it/s]
100%|      | 30/30 [00:00<00:00, 96.28it/s]
100%|      | 30/30 [00:00<00:00, 83.69it/s]
100%|      | 30/30 [00:00<00:00, 101.74it/s]
100%|      | 30/30 [00:00<00:00, 98.61it/s]
100%|      | 30/30 [00:00<00:00, 94.65it/s]
100%|      | 30/30 [00:00<00:00, 103.41it/s]
100%|      | 30/30 [00:00<00:00, 95.13it/s]
100%|      | 30/30 [00:00<00:00, 87.07it/s]
100%|      | 30/30 [00:00<00:00, 100.44it/s]
100%|      | 30/30 [00:00<00:00, 90.07it/s]
100%|      | 30/30 [00:00<00:00, 90.61it/s]
100%|      | 30/30 [00:00<00:00, 104.98it/s]
```

```
100%|      | 30/30 [00:00<00:00, 102.70it/s]
100%|      | 30/30 [00:00<00:00, 102.45it/s]
100%|      | 30/30 [00:00<00:00, 87.53it/s]
100%|      | 30/30 [00:00<00:00, 96.22it/s]
100%|      | 30/30 [00:00<00:00, 90.46it/s]
100%|      | 30/30 [00:00<00:00, 93.53it/s]
100%|      | 30/30 [00:00<00:00, 107.39it/s]
100%|      | 30/30 [00:00<00:00, 105.16it/s]
100%|      | 30/30 [00:00<00:00, 100.02it/s]
100%|      | 30/30 [00:00<00:00, 104.52it/s]
100%|      | 30/30 [00:00<00:00, 107.38it/s]
100%|      | 30/30 [00:00<00:00, 104.17it/s]
100%|      | 30/30 [00:00<00:00, 99.40it/s]
100%|      | 30/30 [00:00<00:00, 102.29it/s]
100%|      | 30/30 [00:00<00:00, 97.78it/s]
100%|      | 30/30 [00:00<00:00, 91.27it/s]
100%|      | 30/30 [00:00<00:00, 101.87it/s]
100%|      | 30/30 [00:00<00:00, 105.16it/s]
100%|      | 30/30 [00:00<00:00, 102.13it/s]
100%|      | 30/30 [00:00<00:00, 99.01it/s]
100%|      | 30/30 [00:00<00:00, 104.42it/s]
100%|      | 30/30 [00:00<00:00, 108.38it/s]
100%|      | 30/30 [00:00<00:00, 99.19it/s]
100%|      | 30/30 [00:00<00:00, 106.02it/s]
100%|      | 30/30 [00:00<00:00, 104.55it/s]
100%|      | 30/30 [00:00<00:00, 90.02it/s]
100%|      | 30/30 [00:00<00:00, 107.51it/s]
100%|      | 30/30 [00:00<00:00, 111.34it/s]
100%|      | 30/30 [00:00<00:00, 98.83it/s]
100%|      | 30/30 [00:00<00:00, 101.54it/s]
100%|      | 30/30 [00:00<00:00, 108.77it/s]
100%|      | 30/30 [00:00<00:00, 98.49it/s]
100%|      | 30/30 [00:00<00:00, 91.05it/s]
100%|      | 30/30 [00:00<00:00, 95.63it/s]
100%|      | 30/30 [00:00<00:00, 92.62it/s]
100%|      | 30/30 [00:00<00:00, 91.41it/s]
100%|      | 30/30 [00:00<00:00, 104.32it/s]
100%|      | 30/30 [00:00<00:00, 99.76it/s]
100%|      | 30/30 [00:00<00:00, 94.07it/s]
100%|      | 30/30 [00:00<00:00, 101.77it/s]
100%|      | 30/30 [00:00<00:00, 92.86it/s]
100%|      | 30/30 [00:00<00:00, 93.53it/s]
100%|      | 30/30 [00:00<00:00, 89.29it/s]
100%|      | 30/30 [00:00<00:00, 84.27it/s]
100%|      | 30/30 [00:00<00:00, 80.73it/s]
100%|      | 30/30 [00:00<00:00, 99.22it/s]
100%|      | 30/30 [00:00<00:00, 99.07it/s]
100%|      | 30/30 [00:00<00:00, 101.69it/s]
```

```
100%|      | 30/30 [00:00<00:00, 102.79it/s]
100%|      | 30/30 [00:00<00:00, 106.96it/s]
100%|      | 30/30 [00:00<00:00, 101.91it/s]
100%|      | 30/30 [00:00<00:00, 100.36it/s]
100%|      | 30/30 [00:00<00:00, 108.15it/s]
100%|      | 30/30 [00:00<00:00, 98.40it/s]
100%|      | 30/30 [00:00<00:00, 101.79it/s]
100%|      | 30/30 [00:00<00:00, 108.65it/s]
100%|      | 30/30 [00:00<00:00, 99.63it/s]
100%|      | 30/30 [00:00<00:00, 92.25it/s]
100%|      | 30/30 [00:00<00:00, 94.14it/s]
100%|      | 30/30 [00:00<00:00, 96.64it/s]
100%|      | 30/30 [00:00<00:00, 94.90it/s]
100%|      | 30/30 [00:00<00:00, 102.70it/s]
100%|      | 30/30 [00:00<00:00, 102.90it/s]
100%|      | 30/30 [00:00<00:00, 95.54it/s]
100%|      | 30/30 [00:00<00:00, 92.11it/s]
100%|      | 30/30 [00:00<00:00, 87.03it/s]
100%|      | 30/30 [00:00<00:00, 94.07it/s]

Epoch 1/5
12/12 [==============================] - 26s 2s/step - loss: 0.1992 - accuracy:
0.9353
Epoch 2/5
12/12 [==============================] - 26s 2s/step - loss: 0.1398 - accuracy:
0.9530
Epoch 3/5
12/12 [==============================] - 26s 2s/step - loss: 0.0927 - accuracy:
0.9663
Epoch 4/5
12/12 [==============================] - 26s 2s/step - loss: 0.0810 - accuracy:
0.9740
Epoch 5/5
12/12 [==============================] - 26s 2s/step - loss: 0.0595 - accuracy:
0.9797
4/4 [==============================] - 2s 582ms/step - loss: 0.0907 - accuracy:
0.9678

100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.14it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.07it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.37it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.54it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
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100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.10it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
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100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
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100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
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100%|      | 30/30 [00:03<00:00,  8.12it/s]
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100%|      | 30/30 [00:03<00:00,  7.70it/s]
100%|      | 30/30 [00:03<00:00,  8.06it/s]
100%|      | 30/30 [00:03<00:00,  7.98it/s]
100%|      | 30/30 [00:03<00:00,  7.87it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  7.63it/s]
100%|      | 30/30 [00:03<00:00,  8.03it/s]
100%|      | 30/30 [00:04<00:00,  7.34it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:03<00:00,  8.06it/s]
100%|      | 30/30 [00:03<00:00,  7.97it/s]

Epoch 1/5
12/12 [==============================] - 27s 2s/step - loss: 0.0413 - accuracy:
0.9930
Epoch 2/5
12/12 [==============================] - 26s 2s/step - loss: 0.0356 - accuracy:
0.9920
Epoch 3/5
```

```
12/12 [==============================] - 27s 2s/step - loss: 0.0326 - accuracy:
0.9940
Epoch 4/5
12/12 [==============================] - 27s 2s/step - loss: 0.0293 - accuracy:
0.9933
Epoch 5/5
12/12 [==============================] - 27s 2s/step - loss: 0.0291 - accuracy:
0.9923
4/4 [==============================] - 3s 601ms/step - loss: 0.1057 - accuracy:
0.9578
Accuracy - None::  0.4211111068725586
Accuracy - jitter::  0.47999998927116394
Accuracy - scaling::  0.7622222304344177
Accuracy - rotation::  0.8122222423553467
Accuracy - permutation::  0.7688888907432556
Accuracy - magnitude_warp::  0.9433333277702332
Accuracy - time_warp::  0.9688888788223267
Accuracy - window_slice::  0.9322222471237183
Accuracy - window_warp::  0.9688888788223267
Accuracy - spawner::  0.9877777695655823
Accuracy - wdba::  0.9788888692855835
Accuracy - random_guided_warp::  0.9677777886390686
Accuracy - discriminative_guided_warp::  0.9577777981758118
```

lstmfcn

[ ]:
```
model = get_model("lstmfcn", input_shape, nb_class)
model.compile(optimizer=optm, loss='categorical_crossentropy',␣
 ↪metrics=['accuracy'])
method_apply_deep(model, x_train, y_train, x_test, y_test)
```

```
Model: "model_1"
__________________________________________________________________________________
__________________
 Layer (type)                   Output Shape         Param #     Connected to
==================================================================================
==================
 input_2 (InputLayer)           [(None, 128, 1)]     0           []

 conv1d (Conv1D)                (None, 128, 128)     1152
['input_2[0][0]']

 batch_normalization (BatchNorm  (None, 128, 128)    512
['conv1d[0][0]']
 alization)

 activation (Activation)        (None, 128, 128)     0
['batch_normalization[0][0]']
```

```
 conv1d_1 (Conv1D)              (None, 128, 256)     164096
['activation[0][0]']

 batch_normalization_1 (BatchNo  (None, 128, 256)    1024
['conv1d_1[0][0]']
 rmalization)

 activation_1 (Activation)      (None, 128, 256)     0
['batch_normalization_1[0][0]']

 conv1d_2 (Conv1D)              (None, 128, 128)     98432
['activation_1[0][0]']

 permute (Permute)              (None, 1, 128)       0
['input_2[0][0]']

 batch_normalization_2 (BatchNo  (None, 128, 128)    512
['conv1d_2[0][0]']
 rmalization)

 lstm_2 (LSTM)                  (None, 128)          131584
['permute[0][0]']

 activation_2 (Activation)      (None, 128, 128)     0
['batch_normalization_2[0][0]']

 dropout (Dropout)              (None, 128)          0
['lstm_2[0][0]']

 global_average_pooling1d (Glob  (None, 128)         0
['activation_2[0][0]']
 alAveragePooling1D)

 concatenate (Concatenate)      (None, 256)          0
['dropout[0][0]',
'global_average_pooling1d[0][0]'
                                                                  ]

 dense_1 (Dense)                (None, 3)            771
['concatenate[0][0]']

==================================================================================
=================
Total params: 398,083
Trainable params: 397,059
Non-trainable params: 1,024
----------------------------------------------------------------------------------
```

```
------------------
Epoch 1/5
1/1 [==============================] - 3s 3s/step - loss: 1.0795 - accuracy:
0.4333
Epoch 2/5
1/1 [==============================] - 0s 166ms/step - loss: 1.0584 - accuracy:
0.4333
Epoch 3/5
1/1 [==============================] - 0s 176ms/step - loss: 1.0576 - accuracy:
0.4000
Epoch 4/5
1/1 [==============================] - 0s 183ms/step - loss: 1.0596 - accuracy:
0.5000
Epoch 5/5
1/1 [==============================] - 0s 178ms/step - loss: 0.9976 - accuracy:
0.5000
4/4 [==============================] - 2s 274ms/step - loss: 1.0935 - accuracy:
0.3322
Epoch 1/5
12/12 [==============================] - 20s 1s/step - loss: 0.8472 - accuracy:
0.7173
Epoch 2/5
12/12 [==============================] - 17s 1s/step - loss: 0.5806 - accuracy:
0.9107
Epoch 3/5
12/12 [==============================] - 17s 1s/step - loss: 0.4178 - accuracy:
0.9647
Epoch 4/5
12/12 [==============================] - 17s 1s/step - loss: 0.3107 - accuracy:
0.9707
Epoch 5/5
12/12 [==============================] - 17s 1s/step - loss: 0.2390 - accuracy:
0.9857
4/4 [==============================] - 1s 276ms/step - loss: 0.8752 - accuracy:
0.3578
Epoch 1/5
12/12 [==============================] - 16s 1s/step - loss: 0.1893 - accuracy:
0.9937
Epoch 2/5
12/12 [==============================] - 16s 1s/step - loss: 0.1521 - accuracy:
0.9970
Epoch 3/5
12/12 [==============================] - 16s 1s/step - loss: 0.1234 - accuracy:
0.9997
Epoch 4/5
12/12 [==============================] - 17s 1s/step - loss: 0.1027 - accuracy:
0.9997
Epoch 5/5
```

```
12/12 [==============================] - 17s 1s/step - loss: 0.0872 - accuracy:
1.0000
4/4 [==============================] - 1s 275ms/step - loss: 0.6828 - accuracy:
0.6122
Epoch 1/5
12/12 [==============================] - 17s 1s/step - loss: 1.3895 - accuracy:
0.5717
Epoch 2/5
12/12 [==============================] - 17s 1s/step - loss: 0.8493 - accuracy:
0.6993
Epoch 3/5
12/12 [==============================] - 17s 1s/step - loss: 0.6632 - accuracy:
0.7223
Epoch 4/5
12/12 [==============================] - 17s 1s/step - loss: 0.5706 - accuracy:
0.7690
Epoch 5/5
12/12 [==============================] - 17s 1s/step - loss: 0.5206 - accuracy:
0.7643
4/4 [==============================] - 1s 275ms/step - loss: 0.5492 - accuracy:
0.9478

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Epoch 1/5
12/12 [==============================] - 16s 1s/step - loss: 0.4482 - accuracy:
0.8743
Epoch 2/5
12/12 [==============================] - 17s 1s/step - loss: 0.2606 - accuracy:
0.9637
Epoch 3/5
12/12 [==============================] - 16s 1s/step - loss: 0.1733 - accuracy:
0.9787
Epoch 4/5
12/12 [==============================] - 16s 1s/step - loss: 0.1242 - accuracy:
0.9920
Epoch 5/5
12/12 [==============================] - 16s 1s/step - loss: 0.0965 - accuracy:
0.9953
4/4 [==============================] - 1s 272ms/step - loss: 0.6206 - accuracy:
```

```
0.7033
Epoch 1/5
12/12 [==============================] - 16s 1s/step - loss: 0.1169 - accuracy:
0.9817
Epoch 2/5
12/12 [==============================] - 16s 1s/step - loss: 0.0988 - accuracy:
0.9857
Epoch 3/5
12/12 [==============================] - 16s 1s/step - loss: 0.0814 - accuracy:
0.9900
Epoch 4/5
12/12 [==============================] - 16s 1s/step - loss: 0.0712 - accuracy:
0.9910
Epoch 5/5
12/12 [==============================] - 16s 1s/step - loss: 0.0622 - accuracy:
0.9920
4/4 [==============================] - 1s 273ms/step - loss: 0.9240 - accuracy:
0.5689
Epoch 1/5
12/12 [==============================] - 16s 1s/step - loss: 0.0277 - accuracy:
1.0000
Epoch 2/5
12/12 [==============================] - 16s 1s/step - loss: 0.0243 - accuracy:
1.0000
Epoch 3/5
12/12 [==============================] - 16s 1s/step - loss: 0.0223 - accuracy:
1.0000
Epoch 4/5
12/12 [==============================] - 16s 1s/step - loss: 0.0209 - accuracy:
1.0000
Epoch 5/5
12/12 [==============================] - 16s 1s/step - loss: 0.0190 - accuracy:
1.0000
4/4 [==============================] - 1s 268ms/step - loss: 0.1637 - accuracy:
0.9456
Epoch 1/5
12/12 [==============================] - 16s 1s/step - loss: 0.0340 - accuracy:
0.9993
Epoch 2/5
12/12 [==============================] - 16s 1s/step - loss: 0.0308 - accuracy:
0.9990
Epoch 3/5
12/12 [==============================] - 16s 1s/step - loss: 0.0277 - accuracy:
0.9990
Epoch 4/5
12/12 [==============================] - 16s 1s/step - loss: 0.0256 - accuracy:
0.9990
Epoch 5/5
```

```
12/12 [==============================] - 16s 1s/step - loss: 0.0242 - accuracy:
0.9987
4/4 [==============================] - 1s 268ms/step - loss: 0.1347 - accuracy:
0.9656
Epoch 1/5
12/12 [==============================] - 16s 1s/step - loss: 0.0234 - accuracy:
0.9990
Epoch 2/5
12/12 [==============================] - 16s 1s/step - loss: 0.0218 - accuracy:
0.9983
Epoch 3/5
12/12 [==============================] - 16s 1s/step - loss: 0.0197 - accuracy:
0.9990
Epoch 4/5
12/12 [==============================] - 16s 1s/step - loss: 0.0185 - accuracy:
0.9990
Epoch 5/5
12/12 [==============================] - 16s 1s/step - loss: 0.0177 - accuracy:
0.9990
4/4 [==============================] - 1s 271ms/step - loss: 0.1780 - accuracy:
0.9500
```

```
100%|      | 30/30 [00:00<00:00, 102.84it/s]
100%|      | 30/30 [00:00<00:00, 98.22it/s]
100%|      | 30/30 [00:00<00:00, 95.59it/s]
100%|      | 30/30 [00:00<00:00, 100.87it/s]
100%|      | 30/30 [00:00<00:00, 103.13it/s]
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100%|      | 30/30 [00:00<00:00, 94.29it/s]
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100%|      | 30/30 [00:00<00:00, 104.56it/s]
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100%|      | 30/30 [00:00<00:00, 106.30it/s]
100%|      | 30/30 [00:00<00:00, 96.52it/s]
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100%|      | 30/30 [00:00<00:00, 103.56it/s]
100%|      | 30/30 [00:00<00:00, 92.88it/s]
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100%|      | 30/30 [00:00<00:00, 100.17it/s]
100%|      | 30/30 [00:00<00:00, 105.11it/s]
100%|      | 30/30 [00:00<00:00, 101.80it/s]
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100%|      | 30/30 [00:00<00:00, 103.34it/s]
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100%|      | 30/30 [00:00<00:00, 105.54it/s]
100%|      | 30/30 [00:00<00:00, 103.67it/s]
100%|      | 30/30 [00:00<00:00, 104.79it/s]
100%|      | 30/30 [00:00<00:00, 95.26it/s]
100%|      | 30/30 [00:00<00:00, 104.34it/s]
100%|      | 30/30 [00:00<00:00, 107.54it/s]
100%|      | 30/30 [00:00<00:00, 103.43it/s]
100%|      | 30/30 [00:00<00:00, 92.97it/s]
100%|      | 30/30 [00:00<00:00, 101.62it/s]
100%|      | 30/30 [00:00<00:00, 102.13it/s]
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100%|      | 30/30 [00:00<00:00, 103.07it/s]
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100%|      | 30/30 [00:00<00:00, 90.87it/s]
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100%|      | 30/30 [00:00<00:00, 100.16it/s]
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100%|      | 30/30 [00:00<00:00, 103.68it/s]
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100%|      | 30/30 [00:00<00:00, 94.92it/s]
100%|      | 30/30 [00:00<00:00, 103.27it/s]
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100%|      | 30/30 [00:00<00:00, 110.71it/s]
100%|      | 30/30 [00:00<00:00, 103.35it/s]
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100%|      | 30/30 [00:00<00:00, 108.61it/s]
100%|      | 30/30 [00:00<00:00, 105.85it/s]
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100%|      | 30/30 [00:00<00:00, 98.97it/s]
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100%|      | 30/30 [00:00<00:00, 105.73it/s]
100%|      | 30/30 [00:00<00:00, 101.40it/s]
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100%|      | 30/30 [00:00<00:00, 104.71it/s]
100%|      | 30/30 [00:00<00:00, 97.69it/s]
100%|      | 30/30 [00:00<00:00, 104.79it/s]
```

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100%|      | 30/30 [00:00<00:00, 109.05it/s]
100%|      | 30/30 [00:00<00:00, 103.70it/s]
100%|      | 30/30 [00:00<00:00, 96.18it/s]
100%|      | 30/30 [00:00<00:00, 96.84it/s]
100%|      | 30/30 [00:00<00:00, 105.17it/s]
100%|      | 30/30 [00:00<00:00, 100.12it/s]
100%|      | 30/30 [00:00<00:00, 105.71it/s]
100%|      | 30/30 [00:00<00:00, 95.01it/s]
100%|      | 30/30 [00:00<00:00, 100.74it/s]
100%|      | 30/30 [00:00<00:00, 100.76it/s]
100%|      | 30/30 [00:00<00:00, 108.36it/s]
100%|      | 30/30 [00:00<00:00, 96.42it/s]
100%|      | 30/30 [00:00<00:00, 104.40it/s]
100%|      | 30/30 [00:00<00:00, 108.06it/s]
100%|      | 30/30 [00:00<00:00, 99.59it/s]
100%|      | 30/30 [00:00<00:00, 105.20it/s]
100%|      | 30/30 [00:00<00:00, 96.19it/s]
100%|      | 30/30 [00:00<00:00, 103.94it/s]
100%|      | 30/30 [00:00<00:00, 105.34it/s]
100%|      | 30/30 [00:00<00:00, 109.02it/s]
100%|      | 30/30 [00:00<00:00, 111.40it/s]
100%|      | 30/30 [00:00<00:00, 108.36it/s]
100%|      | 30/30 [00:00<00:00, 99.86it/s]
100%|      | 30/30 [00:00<00:00, 103.31it/s]
100%|      | 30/30 [00:00<00:00, 99.19it/s]

Epoch 1/5
12/12 [==============================] - 16s 1s/step - loss: 0.4128 - accuracy:
0.8190
Epoch 2/5
12/12 [==============================] - 16s 1s/step - loss: 0.3322 - accuracy:
0.8450
Epoch 3/5
12/12 [==============================] - 16s 1s/step - loss: 0.3110 - accuracy:
0.8590
Epoch 4/5
12/12 [==============================] - 17s 1s/step - loss: 0.2984 - accuracy:
0.8670
Epoch 5/5
12/12 [==============================] - 17s 1s/step - loss: 0.2889 - accuracy:
0.8677
4/4 [==============================] - 1s 273ms/step - loss: 0.8330 - accuracy:
0.5978

100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
```

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100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.91it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.93it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.92it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.75it/s]
100%|      | 30/30 [00:08<00:00,  3.73it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:08<00:00,  3.71it/s]
100%|      | 30/30 [00:08<00:00,  3.69it/s]
100%|      | 30/30 [00:08<00:00,  3.62it/s]
100%|      | 30/30 [00:08<00:00,  3.73it/s]
100%|      | 30/30 [00:08<00:00,  3.65it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:08<00:00,  3.73it/s]
100%|      | 30/30 [00:08<00:00,  3.69it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.75it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:08<00:00,  3.75it/s]
100%|      | 30/30 [00:08<00:00,  3.73it/s]
100%|      | 30/30 [00:08<00:00,  3.71it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:08<00:00,  3.72it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:08<00:00,  3.73it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:08<00:00,  3.73it/s]
100%|      | 30/30 [00:08<00:00,  3.75it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:08<00:00,  3.72it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.75it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:08<00:00,  3.70it/s]
100%|      | 30/30 [00:08<00:00,  3.70it/s]
100%|      | 30/30 [00:08<00:00,  3.67it/s]

Epoch 1/5
```

```
12/12 [==============================] - 17s 1s/step - loss: 0.0153 - accuracy:
1.0000
Epoch 2/5
12/12 [==============================] - 17s 1s/step - loss: 0.0121 - accuracy:
0.9997
Epoch 3/5
12/12 [==============================] - 17s 1s/step - loss: 0.0106 - accuracy:
0.9997
Epoch 4/5
12/12 [==============================] - 17s 1s/step - loss: 0.0083 - accuracy:
0.9997
Epoch 5/5
12/12 [==============================] - 16s 1s/step - loss: 0.0069 - accuracy:
1.0000
4/4 [==============================] - 1s 273ms/step - loss: 0.0953 - accuracy:
0.9911
```

```
100%|      | 30/30 [00:00<00:00, 97.92it/s]
100%|      | 30/30 [00:00<00:00, 93.93it/s]
100%|      | 30/30 [00:00<00:00, 107.35it/s]
100%|      | 30/30 [00:00<00:00, 95.30it/s]
100%|      | 30/30 [00:00<00:00, 93.10it/s]
100%|      | 30/30 [00:00<00:00, 106.80it/s]
100%|      | 30/30 [00:00<00:00, 106.90it/s]
100%|      | 30/30 [00:00<00:00, 101.47it/s]
100%|      | 30/30 [00:00<00:00, 100.66it/s]
100%|      | 30/30 [00:00<00:00, 102.36it/s]
100%|      | 30/30 [00:00<00:00, 107.98it/s]
100%|      | 30/30 [00:00<00:00, 97.66it/s]
100%|      | 30/30 [00:00<00:00, 90.24it/s]
100%|      | 30/30 [00:00<00:00, 90.82it/s]
100%|      | 30/30 [00:00<00:00, 92.44it/s]
100%|      | 30/30 [00:00<00:00, 104.56it/s]
100%|      | 30/30 [00:00<00:00, 102.38it/s]
100%|      | 30/30 [00:00<00:00, 105.24it/s]
100%|      | 30/30 [00:00<00:00, 96.63it/s]
100%|      | 30/30 [00:00<00:00, 92.35it/s]
100%|      | 30/30 [00:00<00:00, 90.43it/s]
100%|      | 30/30 [00:00<00:00, 101.85it/s]
100%|      | 30/30 [00:00<00:00, 109.96it/s]
100%|      | 30/30 [00:00<00:00, 105.06it/s]
100%|      | 30/30 [00:00<00:00, 95.77it/s]
100%|      | 30/30 [00:00<00:00, 100.29it/s]
100%|      | 30/30 [00:00<00:00, 100.61it/s]
100%|      | 30/30 [00:00<00:00, 91.42it/s]
100%|      | 30/30 [00:00<00:00, 92.87it/s]
100%|      | 30/30 [00:00<00:00, 103.71it/s]
100%|      | 30/30 [00:00<00:00, 89.55it/s]
```

```
100%|      | 30/30 [00:00<00:00, 97.13it/s]
100%|      | 30/30 [00:00<00:00, 101.48it/s]
100%|      | 30/30 [00:00<00:00, 90.35it/s]
100%|      | 30/30 [00:00<00:00, 93.68it/s]
100%|      | 30/30 [00:00<00:00, 104.70it/s]
100%|      | 30/30 [00:00<00:00, 93.73it/s]
100%|      | 30/30 [00:00<00:00, 100.64it/s]
100%|      | 30/30 [00:00<00:00, 96.88it/s]
100%|      | 30/30 [00:00<00:00, 97.57it/s]
100%|      | 30/30 [00:00<00:00, 94.52it/s]
100%|      | 30/30 [00:00<00:00, 95.12it/s]
100%|      | 30/30 [00:00<00:00, 94.93it/s]
100%|      | 30/30 [00:00<00:00, 88.14it/s]
100%|      | 30/30 [00:00<00:00, 94.21it/s]
100%|      | 30/30 [00:00<00:00, 95.08it/s]
100%|      | 30/30 [00:00<00:00, 96.07it/s]
100%|      | 30/30 [00:00<00:00, 96.47it/s]
100%|      | 30/30 [00:00<00:00, 97.62it/s]
100%|      | 30/30 [00:00<00:00, 92.20it/s]
100%|      | 30/30 [00:00<00:00, 104.86it/s]
100%|      | 30/30 [00:00<00:00, 104.25it/s]
100%|      | 30/30 [00:00<00:00, 101.85it/s]
100%|      | 30/30 [00:00<00:00, 101.84it/s]
100%|      | 30/30 [00:00<00:00, 102.00it/s]
100%|      | 30/30 [00:00<00:00, 103.32it/s]
100%|      | 30/30 [00:00<00:00, 96.20it/s]
100%|      | 30/30 [00:00<00:00, 99.66it/s]
100%|      | 30/30 [00:00<00:00, 107.56it/s]
100%|      | 30/30 [00:00<00:00, 98.93it/s]
100%|      | 30/30 [00:00<00:00, 102.90it/s]
100%|      | 30/30 [00:00<00:00, 103.24it/s]
100%|      | 30/30 [00:00<00:00, 100.43it/s]
100%|      | 30/30 [00:00<00:00, 99.95it/s]
100%|      | 30/30 [00:00<00:00, 96.30it/s]
100%|      | 30/30 [00:00<00:00, 99.72it/s]
100%|      | 30/30 [00:00<00:00, 97.80it/s]
100%|      | 30/30 [00:00<00:00, 96.31it/s]
100%|      | 30/30 [00:00<00:00, 88.32it/s]
100%|      | 30/30 [00:00<00:00, 99.54it/s]
100%|      | 30/30 [00:00<00:00, 109.06it/s]
100%|      | 30/30 [00:00<00:00, 94.52it/s]
100%|      | 30/30 [00:00<00:00, 99.73it/s]
100%|      | 30/30 [00:00<00:00, 99.69it/s]
100%|      | 30/30 [00:00<00:00, 94.34it/s]
100%|      | 30/30 [00:00<00:00, 94.20it/s]
100%|      | 30/30 [00:00<00:00, 98.49it/s]
100%|      | 30/30 [00:00<00:00, 94.10it/s]
100%|      | 30/30 [00:00<00:00, 89.19it/s]
```

```
100%|      | 30/30 [00:00<00:00, 100.72it/s]
100%|      | 30/30 [00:00<00:00, 103.95it/s]
100%|      | 30/30 [00:00<00:00, 99.12it/s]
100%|      | 30/30 [00:00<00:00, 101.52it/s]
100%|      | 30/30 [00:00<00:00, 97.57it/s]
100%|      | 30/30 [00:00<00:00, 103.63it/s]
100%|      | 30/30 [00:00<00:00, 93.56it/s]
100%|      | 30/30 [00:00<00:00, 94.29it/s]
100%|      | 30/30 [00:00<00:00, 102.48it/s]
100%|      | 30/30 [00:00<00:00, 97.44it/s]
100%|      | 30/30 [00:00<00:00, 102.38it/s]
100%|      | 30/30 [00:00<00:00, 105.93it/s]
100%|      | 30/30 [00:00<00:00, 89.95it/s]
100%|      | 30/30 [00:00<00:00, 96.89it/s]
100%|      | 30/30 [00:00<00:00, 85.79it/s]
100%|      | 30/30 [00:00<00:00, 88.22it/s]
100%|      | 30/30 [00:00<00:00, 104.17it/s]
100%|      | 30/30 [00:00<00:00, 105.99it/s]
100%|      | 30/30 [00:00<00:00, 102.52it/s]
100%|      | 30/30 [00:00<00:00, 103.78it/s]
```

```
Epoch 1/5
12/12 [==============================] - 16s 1s/step - loss: 0.0605 - accuracy:
0.9893
Epoch 2/5
12/12 [==============================] - 16s 1s/step - loss: 0.0531 - accuracy:
0.9940
Epoch 3/5
12/12 [==============================] - 16s 1s/step - loss: 0.0466 - accuracy:
0.9953
Epoch 4/5
12/12 [==============================] - 16s 1s/step - loss: 0.0414 - accuracy:
0.9957
Epoch 5/5
12/12 [==============================] - 16s 1s/step - loss: 0.0391 - accuracy:
0.9960
4/4 [==============================] - 1s 270ms/step - loss: 0.1676 - accuracy:
0.9467
```

```
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.09it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.06it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  7.96it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.04it/s]
100%|      | 30/30 [00:03<00:00,  8.02it/s]
100%|      | 30/30 [00:03<00:00,  7.99it/s]
100%|      | 30/30 [00:03<00:00,  8.08it/s]
100%|      | 30/30 [00:03<00:00,  7.93it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.16it/s]
100%|      | 30/30 [00:03<00:00,  8.05it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  7.97it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  7.99it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.14it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.06it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.09it/s]
100%|      | 30/30 [00:03<00:00,  8.02it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.06it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  7.87it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.06it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.08it/s]
100%|      | 30/30 [00:03<00:00,  7.79it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.02it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.04it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.06it/s]
100%|      | 30/30 [00:03<00:00,  8.14it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.14it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]

Epoch 1/5
12/12 [==============================] - 16s 1s/step - loss: 0.0404 - accuracy:
0.9933
Epoch 2/5
12/12 [==============================] - 16s 1s/step - loss: 0.0379 - accuracy:
0.9950
```

```
Epoch 3/5
12/12 [==============================] - 16s 1s/step - loss: 0.0354 - accuracy:
0.9950
Epoch 4/5
12/12 [==============================] - 16s 1s/step - loss: 0.0336 - accuracy:
0.9953
Epoch 5/5
12/12 [==============================] - 16s 1s/step - loss: 0.0317 - accuracy:
0.9953
4/4 [==============================] - 1s 272ms/step - loss: 0.2974 - accuracy:
0.9089
Accuracy - None::  0.33222222328186035
Accuracy - jitter::  0.35777777433395386
Accuracy - scaling::  0.6122221946716309
Accuracy - rotation::  0.9477777481079102
Accuracy - permutation::  0.70333331823349
Accuracy - magnitude_warp::  0.5688889026641846
Accuracy - time_warp::  0.945555567741394
Accuracy - window_slice::  0.9655555486679077
Accuracy - window_warp::  0.949999988079071
Accuracy - spawner::  0.597777783870697
Accuracy - wdba::  0.9911110997200012
Accuracy - random_guided_warp::  0.9466666579246521
Accuracy - discriminative_guided_warp::  0.9088888764381409
```

resnet

[ ]:
```
model = get_model("resnet", input_shape, nb_class)
model.compile(optimizer=optm, loss='categorical_crossentropy',␣
 ↪metrics=['accuracy'])
method_apply_deep(model, x_train, y_train, x_test, y_test)
```

```
Model: "model_2"
__________________________________________________________________________________
__________________
 Layer (type)                   Output Shape         Param #     Connected to
==================================================================================
==================
 input_3 (InputLayer)           [(None, 128, 1)]     0           []

 conv1d_3 (Conv1D)              (None, 128, 64)      576
['input_3[0][0]']

 batch_normalization_3 (BatchNo  (None, 128, 64)     256
['conv1d_3[0][0]']
 rmalization)

 activation_3 (Activation)      (None, 128, 64)      0
```

```
['batch_normalization_3[0][0]']

 conv1d_4 (Conv1D)              (None, 128, 64)      20544
['activation_3[0][0]']

 batch_normalization_4 (BatchNo  (None, 128, 64)     256
['conv1d_4[0][0]']
 rmalization)

 activation_4 (Activation)      (None, 128, 64)      0
['batch_normalization_4[0][0]']

 conv1d_5 (Conv1D)              (None, 128, 64)      12352
['activation_4[0][0]']

 conv1d_6 (Conv1D)              (None, 128, 64)      128
['input_3[0][0]']

 batch_normalization_5 (BatchNo  (None, 128, 64)     256
['conv1d_5[0][0]']
 rmalization)

 batch_normalization_6 (BatchNo  (None, 128, 64)     256
['conv1d_6[0][0]']
 rmalization)

 activation_5 (Activation)      (None, 128, 64)      0
['batch_normalization_5[0][0]']

 add (Add)                      (None, 128, 64)      0
['batch_normalization_6[0][0]',
'activation_5[0][0]']

 activation_6 (Activation)      (None, 128, 64)      0           ['add[0][0]']

 conv1d_7 (Conv1D)              (None, 128, 128)     65664
['activation_6[0][0]']

 batch_normalization_7 (BatchNo  (None, 128, 128)    512
['conv1d_7[0][0]']
 rmalization)

 activation_7 (Activation)      (None, 128, 128)     0
['batch_normalization_7[0][0]']

 conv1d_8 (Conv1D)              (None, 128, 128)     82048
['activation_7[0][0]']
```

```
 batch_normalization_8 (BatchNo  (None, 128, 128)    512
['conv1d_8[0][0]']
 rmalization)

 activation_8 (Activation)      (None, 128, 128)     0
['batch_normalization_8[0][0]']

 conv1d_9 (Conv1D)              (None, 128, 128)     49280
['activation_8[0][0]']

 conv1d_10 (Conv1D)             (None, 128, 128)     8320
['activation_6[0][0]']

 batch_normalization_9 (BatchNo  (None, 128, 128)    512
['conv1d_9[0][0]']
 rmalization)

 batch_normalization_10 (BatchN  (None, 128, 128)    512
['conv1d_10[0][0]']
 ormalization)

 activation_9 (Activation)      (None, 128, 128)     0
['batch_normalization_9[0][0]']

 add_1 (Add)                    (None, 128, 128)     0
['batch_normalization_10[0][0]',
'activation_9[0][0]']

 activation_10 (Activation)     (None, 128, 128)     0           ['add_1[0][0]']

 conv1d_11 (Conv1D)             (None, 128, 128)     131200
['activation_10[0][0]']

 batch_normalization_11 (BatchN  (None, 128, 128)    512
['conv1d_11[0][0]']
 ormalization)

 activation_11 (Activation)     (None, 128, 128)     0
['batch_normalization_11[0][0]']

 conv1d_12 (Conv1D)             (None, 128, 128)     82048
['activation_11[0][0]']

 batch_normalization_12 (BatchN  (None, 128, 128)    512
['conv1d_12[0][0]']
 ormalization)

 activation_12 (Activation)     (None, 128, 128)     0
```

```
['batch_normalization_12[0][0]']

 conv1d_13 (Conv1D)             (None, 128, 128)     49280
['activation_12[0][0]']

 batch_normalization_13 (BatchN  (None, 128, 128)    512
['conv1d_13[0][0]']
 ormalization)

 batch_normalization_14 (BatchN  (None, 128, 128)    512
['activation_10[0][0]']
 ormalization)

 activation_13 (Activation)     (None, 128, 128)     0
['batch_normalization_13[0][0]']

 add_2 (Add)                    (None, 128, 128)     0
['batch_normalization_14[0][0]',
'activation_13[0][0]']

 activation_14 (Activation)     (None, 128, 128)     0           ['add_2[0][0]']

 global_average_pooling1d_1 (Gl  (None, 128)         0
['activation_14[0][0]']
 obalAveragePooling1D)

 dense_2 (Dense)                (None, 3)            387
['global_average_pooling1d_1[0][0
                                                                ]']

==========================================================================
==================
Total params: 506,947
Trainable params: 504,387
Non-trainable params: 2,560
--------------------------------------------------------------------------
------------------
Epoch 1/5
1/1 [==============================] - 4s 4s/step - loss: 1.1351 - accuracy:
0.4000
Epoch 2/5
1/1 [==============================] - 0s 353ms/step - loss: 1.0509 - accuracy:
0.4000
Epoch 3/5
1/1 [==============================] - 0s 354ms/step - loss: 0.9175 - accuracy:
0.4000
Epoch 4/5
1/1 [==============================] - 0s 345ms/step - loss: 0.7790 - accuracy:
```

```
0.7000
Epoch 5/5
1/1 [==============================] - 0s 341ms/step - loss: 0.6665 - accuracy:
0.9333
4/4 [==============================] - 3s 540ms/step - loss: 1.0955 - accuracy:
0.3456
Epoch 1/5
12/12 [==============================] - 36s 3s/step - loss: 0.3703 - accuracy:
0.9390
Epoch 2/5
12/12 [==============================] - 34s 3s/step - loss: 0.1308 - accuracy:
0.9743
Epoch 3/5
12/12 [==============================] - 34s 3s/step - loss: 0.0595 - accuracy:
1.0000
Epoch 4/5
12/12 [==============================] - 34s 3s/step - loss: 0.0324 - accuracy:
1.0000
Epoch 5/5
12/12 [==============================] - 34s 3s/step - loss: 0.0208 - accuracy:
1.0000
4/4 [==============================] - 2s 543ms/step - loss: 1.1106 - accuracy:
0.3311
Epoch 1/5
12/12 [==============================] - 34s 3s/step - loss: 0.0199 - accuracy:
1.0000
Epoch 2/5
12/12 [==============================] - 34s 3s/step - loss: 0.0153 - accuracy:
1.0000
Epoch 3/5
12/12 [==============================] - 34s 3s/step - loss: 0.0125 - accuracy:
1.0000
Epoch 4/5
12/12 [==============================] - 34s 3s/step - loss: 0.0099 - accuracy:
1.0000
Epoch 5/5
12/12 [==============================] - 34s 3s/step - loss: 0.0086 - accuracy:
1.0000
4/4 [==============================] - 2s 540ms/step - loss: 1.2472 - accuracy:
0.3311
Epoch 1/5
12/12 [==============================] - 34s 3s/step - loss: 1.1330 - accuracy:
0.6780
Epoch 2/5
12/12 [==============================] - 34s 3s/step - loss: 0.4652 - accuracy:
0.8267
Epoch 3/5
12/12 [==============================] - 34s 3s/step - loss: 0.2658 - accuracy:
```

```
0.9703
Epoch 4/5
12/12 [==============================] - 34s 3s/step - loss: 0.1253 - accuracy:
0.9983
Epoch 5/5
12/12 [==============================] - 34s 3s/step - loss: 0.0517 - accuracy:
1.0000
4/4 [==============================] - 2s 536ms/step - loss: 2.0435 - accuracy:
0.3333

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Epoch 1/5
12/12 [==============================] - 34s 3s/step - loss: 0.0468 - accuracy:
0.9970
Epoch 2/5
12/12 [==============================] - 34s 3s/step - loss: 0.0149 - accuracy:
1.0000
Epoch 3/5
12/12 [==============================] - 34s 3s/step - loss: 0.0092 - accuracy:
1.0000
Epoch 4/5
12/12 [==============================] - 34s 3s/step - loss: 0.0072 - accuracy:
1.0000
Epoch 5/5
12/12 [==============================] - 34s 3s/step - loss: 0.0053 - accuracy:
1.0000
4/4 [==============================] - 2s 539ms/step - loss: 2.6388 - accuracy:
0.3333
Epoch 1/5
12/12 [==============================] - 35s 3s/step - loss: 0.0501 - accuracy:
0.9867
Epoch 2/5
12/12 [==============================] - 34s 3s/step - loss: 0.0246 - accuracy:
0.9963
Epoch 3/5
12/12 [==============================] - 35s 3s/step - loss: 0.0155 - accuracy:
0.9997
Epoch 4/5
12/12 [==============================] - 34s 3s/step - loss: 0.0106 - accuracy:
```

```
0.9997
Epoch 5/5
12/12 [==============================] - 34s 3s/step - loss: 0.0081 - accuracy:
0.9997
4/4 [==============================] - 2s 537ms/step - loss: 2.3571 - accuracy:
0.3333
Epoch 1/5
12/12 [==============================] - 35s 3s/step - loss: 0.0027 - accuracy:
1.0000
Epoch 2/5
12/12 [==============================] - 35s 3s/step - loss: 0.0019 - accuracy:
1.0000
Epoch 3/5
12/12 [==============================] - 35s 3s/step - loss: 0.0017 - accuracy:
1.0000
Epoch 4/5
12/12 [==============================] - 35s 3s/step - loss: 0.0015 - accuracy:
1.0000
Epoch 5/5
12/12 [==============================] - 35s 3s/step - loss: 0.0014 - accuracy:
1.0000
4/4 [==============================] - 2s 541ms/step - loss: 2.5830 - accuracy:
0.3333
Epoch 1/5
12/12 [==============================] - 34s 3s/step - loss: 0.0054 - accuracy:
1.0000
Epoch 2/5
12/12 [==============================] - 34s 3s/step - loss: 0.0040 - accuracy:
0.9997
Epoch 3/5
12/12 [==============================] - 34s 3s/step - loss: 0.0031 - accuracy:
1.0000
Epoch 4/5
12/12 [==============================] - 34s 3s/step - loss: 0.0029 - accuracy:
1.0000
Epoch 5/5
12/12 [==============================] - 34s 3s/step - loss: 0.0026 - accuracy:
1.0000
4/4 [==============================] - 2s 538ms/step - loss: 1.7777 - accuracy:
0.3789
Epoch 1/5
12/12 [==============================] - 34s 3s/step - loss: 0.0039 - accuracy:
1.0000
Epoch 2/5
12/12 [==============================] - 34s 3s/step - loss: 0.0033 - accuracy:
1.0000
Epoch 3/5
12/12 [==============================] - 34s 3s/step - loss: 0.0025 - accuracy:
```

```
1.0000
Epoch 4/5
12/12 [==============================] - 34s 3s/step - loss: 0.0024 - accuracy:
1.0000
Epoch 5/5
12/12 [==============================] - 34s 3s/step - loss: 0.0022 - accuracy:
1.0000
4/4 [==============================] - 2s 537ms/step - loss: 0.8880 - accuracy:
0.6056

100%|      | 30/30 [00:00<00:00, 104.82it/s]
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100%|      | 30/30 [00:00<00:00, 101.07it/s]
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100%|      | 30/30 [00:00<00:00, 99.93it/s]
100%|      | 30/30 [00:00<00:00, 97.99it/s]
100%|      | 30/30 [00:00<00:00, 106.03it/s]
100%|      | 30/30 [00:00<00:00, 102.17it/s]
100%|      | 30/30 [00:00<00:00, 110.21it/s]
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```

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100%|      | 30/30 [00:00<00:00, 101.01it/s]
100%|      | 30/30 [00:00<00:00, 106.29it/s]
100%|      | 30/30 [00:00<00:00, 102.05it/s]
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100%|      | 30/30 [00:00<00:00, 102.83it/s]
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100%|      | 30/30 [00:00<00:00, 103.70it/s]
100%|      | 30/30 [00:00<00:00, 98.65it/s]
```

```
Epoch 1/5
12/12 [==============================] - 34s 3s/step - loss: 0.3739 - accuracy:
0.8557
Epoch 2/5
12/12 [==============================] - 34s 3s/step - loss: 0.2374 - accuracy:
0.8967
Epoch 3/5
12/12 [==============================] - 34s 3s/step - loss: 0.2096 - accuracy:
0.9107
Epoch 4/5
12/12 [==============================] - 34s 3s/step - loss: 0.1791 - accuracy:
0.9260
Epoch 5/5
12/12 [==============================] - 34s 3s/step - loss: 0.1543 - accuracy:
0.9373
4/4 [==============================] - 2s 536ms/step - loss: 1.3098 - accuracy:
0.5933
```

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100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
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100%|      | 30/30 [00:07<00:00,  3.81it/s]
```

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100%|      | 30/30 [00:07<00:00,  3.84it/s]
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100%|      | 30/30 [00:07<00:00,  3.88it/s]
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100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
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100%|      | 30/30 [00:07<00:00,  3.81it/s]
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100%|      | 30/30 [00:07<00:00,  3.82it/s]
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100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.75it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:08<00:00,  3.69it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:08<00:00,  3.75it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]

Epoch 1/5
12/12 [==============================] - 35s 3s/step - loss: 0.0039 - accuracy:
1.0000
Epoch 2/5
12/12 [==============================] - 34s 3s/step - loss: 0.0022 - accuracy:
1.0000
Epoch 3/5
12/12 [==============================] - 34s 3s/step - loss: 0.0013 - accuracy:
1.0000
Epoch 4/5
12/12 [==============================] - 35s 3s/step - loss: 0.0010 - accuracy:
1.0000
Epoch 5/5
```

```
12/12 [==============================] - 35s 3s/step - loss: 0.0010 - accuracy:
1.0000
4/4 [==============================] - 2s 540ms/step - loss: 0.1165 - accuracy:
0.9767

100%|      | 30/30 [00:00<00:00, 97.13it/s]
100%|      | 30/30 [00:00<00:00, 99.67it/s]
100%|      | 30/30 [00:00<00:00, 97.96it/s]
100%|      | 30/30 [00:00<00:00, 98.62it/s]
100%|      | 30/30 [00:00<00:00, 99.90it/s]
100%|      | 30/30 [00:00<00:00, 105.41it/s]
100%|      | 30/30 [00:00<00:00, 95.58it/s]
100%|      | 30/30 [00:00<00:00, 88.45it/s]
100%|      | 30/30 [00:00<00:00, 85.22it/s]
100%|      | 30/30 [00:00<00:00, 102.71it/s]
100%|      | 30/30 [00:00<00:00, 93.82it/s]
100%|      | 30/30 [00:00<00:00, 97.79it/s]
100%|      | 30/30 [00:00<00:00, 91.89it/s]
100%|      | 30/30 [00:00<00:00, 90.80it/s]
100%|      | 30/30 [00:00<00:00, 104.77it/s]
100%|      | 30/30 [00:00<00:00, 98.38it/s]
100%|      | 30/30 [00:00<00:00, 88.94it/s]
100%|      | 30/30 [00:00<00:00, 89.88it/s]
100%|      | 30/30 [00:00<00:00, 85.39it/s]
100%|      | 30/30 [00:00<00:00, 96.61it/s]
100%|      | 30/30 [00:00<00:00, 88.45it/s]
100%|      | 30/30 [00:00<00:00, 101.97it/s]
100%|      | 30/30 [00:00<00:00, 99.45it/s]
100%|      | 30/30 [00:00<00:00, 90.91it/s]
100%|      | 30/30 [00:00<00:00, 88.73it/s]
100%|      | 30/30 [00:00<00:00, 103.33it/s]
100%|      | 30/30 [00:00<00:00, 98.58it/s]
100%|      | 30/30 [00:00<00:00, 97.96it/s]
100%|      | 30/30 [00:00<00:00, 101.87it/s]
100%|      | 30/30 [00:00<00:00, 96.70it/s]
100%|      | 30/30 [00:00<00:00, 101.09it/s]
100%|      | 30/30 [00:00<00:00, 91.10it/s]
100%|      | 30/30 [00:00<00:00, 99.46it/s]
100%|      | 30/30 [00:00<00:00, 102.23it/s]
100%|      | 30/30 [00:00<00:00, 107.80it/s]
100%|      | 30/30 [00:00<00:00, 105.90it/s]
100%|      | 30/30 [00:00<00:00, 103.13it/s]
100%|      | 30/30 [00:00<00:00, 100.02it/s]
100%|      | 30/30 [00:00<00:00, 93.45it/s]
100%|      | 30/30 [00:00<00:00, 98.50it/s]
100%|      | 30/30 [00:00<00:00, 100.63it/s]
100%|      | 30/30 [00:00<00:00, 104.14it/s]
100%|      | 30/30 [00:00<00:00, 104.15it/s]
```

```
100%|      | 30/30 [00:00<00:00, 85.16it/s]
100%|      | 30/30 [00:00<00:00, 96.21it/s]
100%|      | 30/30 [00:00<00:00, 100.91it/s]
100%|      | 30/30 [00:00<00:00, 101.45it/s]
100%|      | 30/30 [00:00<00:00, 95.15it/s]
100%|      | 30/30 [00:00<00:00, 93.83it/s]
100%|      | 30/30 [00:00<00:00, 104.98it/s]
100%|      | 30/30 [00:00<00:00, 108.95it/s]
100%|      | 30/30 [00:00<00:00, 108.68it/s]
100%|      | 30/30 [00:00<00:00, 94.49it/s]
100%|      | 30/30 [00:00<00:00, 87.95it/s]
100%|      | 30/30 [00:00<00:00, 100.42it/s]
100%|      | 30/30 [00:00<00:00, 90.45it/s]
100%|      | 30/30 [00:00<00:00, 84.78it/s]
100%|      | 30/30 [00:00<00:00, 86.03it/s]
100%|      | 30/30 [00:00<00:00, 94.62it/s]
100%|      | 30/30 [00:00<00:00, 98.75it/s]
100%|      | 30/30 [00:00<00:00, 106.19it/s]
100%|      | 30/30 [00:00<00:00, 97.55it/s]
100%|      | 30/30 [00:00<00:00, 98.70it/s]
100%|      | 30/30 [00:00<00:00, 100.50it/s]
100%|      | 30/30 [00:00<00:00, 102.56it/s]
100%|      | 30/30 [00:00<00:00, 95.56it/s]
100%|      | 30/30 [00:00<00:00, 106.11it/s]
100%|      | 30/30 [00:00<00:00, 91.77it/s]
100%|      | 30/30 [00:00<00:00, 101.55it/s]
100%|      | 30/30 [00:00<00:00, 102.13it/s]
100%|      | 30/30 [00:00<00:00, 98.52it/s]
100%|      | 30/30 [00:00<00:00, 91.15it/s]
100%|      | 30/30 [00:00<00:00, 86.69it/s]
100%|      | 30/30 [00:00<00:00, 103.05it/s]
100%|      | 30/30 [00:00<00:00, 91.77it/s]
100%|      | 30/30 [00:00<00:00, 103.81it/s]
100%|      | 30/30 [00:00<00:00, 99.12it/s]
100%|      | 30/30 [00:00<00:00, 101.70it/s]
100%|      | 30/30 [00:00<00:00, 101.23it/s]
100%|      | 30/30 [00:00<00:00, 90.41it/s]
100%|      | 30/30 [00:00<00:00, 97.58it/s]
100%|      | 30/30 [00:00<00:00, 102.96it/s]
100%|      | 30/30 [00:00<00:00, 97.06it/s]
100%|      | 30/30 [00:00<00:00, 100.52it/s]
100%|      | 30/30 [00:00<00:00, 105.33it/s]
100%|      | 30/30 [00:00<00:00, 98.99it/s]
100%|      | 30/30 [00:00<00:00, 97.00it/s]
100%|      | 30/30 [00:00<00:00, 96.00it/s]
100%|      | 30/30 [00:00<00:00, 99.83it/s]
100%|      | 30/30 [00:00<00:00, 107.36it/s]
100%|      | 30/30 [00:00<00:00, 95.27it/s]
```

```
100%|      | 30/30 [00:00<00:00, 102.21it/s]
100%|      | 30/30 [00:00<00:00, 91.73it/s]
100%|      | 30/30 [00:00<00:00, 98.57it/s]
100%|      | 30/30 [00:00<00:00, 98.67it/s]
100%|      | 30/30 [00:00<00:00, 93.53it/s]
100%|      | 30/30 [00:00<00:00, 98.35it/s]
100%|      | 30/30 [00:00<00:00, 103.85it/s]
100%|      | 30/30 [00:00<00:00, 98.55it/s]

Epoch 1/5
12/12 [==============================] - 35s 3s/step - loss: 0.0157 - accuracy:
0.9990
Epoch 2/5
12/12 [==============================] - 35s 3s/step - loss: 0.0084 - accuracy:
1.0000
Epoch 3/5
12/12 [==============================] - 34s 3s/step - loss: 0.0061 - accuracy:
1.0000
Epoch 4/5
12/12 [==============================] - 34s 3s/step - loss: 0.0047 - accuracy:
1.0000
Epoch 5/5
12/12 [==============================] - 34s 3s/step - loss: 0.0041 - accuracy:
1.0000
4/4 [==============================] - 2s 552ms/step - loss: 0.0518 - accuracy:
0.9889

100%|      | 30/30 [00:03<00:00,  8.07it/s]
100%|      | 30/30 [00:03<00:00,  7.80it/s]
100%|      | 30/30 [00:03<00:00,  7.52it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.07it/s]
100%|      | 30/30 [00:03<00:00,  8.16it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.07it/s]
100%|      | 30/30 [00:03<00:00,  7.96it/s]
100%|      | 30/30 [00:03<00:00,  8.09it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  7.90it/s]
100%|      | 30/30 [00:03<00:00,  7.97it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  7.89it/s]
100%|      | 30/30 [00:03<00:00,  8.00it/s]
100%|      | 30/30 [00:03<00:00,  7.99it/s]
100%|      | 30/30 [00:03<00:00,  8.06it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  7.81it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.03it/s]
100%|      | 30/30 [00:03<00:00,  8.07it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.07it/s]
100%|      | 30/30 [00:03<00:00,  8.06it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.05it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.07it/s]
100%|      | 30/30 [00:03<00:00,  8.02it/s]
100%|      | 30/30 [00:03<00:00,  7.94it/s]
100%|      | 30/30 [00:03<00:00,  8.14it/s]
100%|      | 30/30 [00:03<00:00,  8.01it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.01it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  7.93it/s]
100%|      | 30/30 [00:03<00:00,  7.95it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.08it/s]
100%|      | 30/30 [00:03<00:00,  8.05it/s]
100%|      | 30/30 [00:03<00:00,  8.02it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.04it/s]
100%|      | 30/30 [00:03<00:00,  7.83it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.04it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  7.93it/s]
100%|      | 30/30 [00:03<00:00,  8.02it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  7.93it/s]
100%|      | 30/30 [00:03<00:00,  7.91it/s]
100%|      | 30/30 [00:03<00:00,  8.10it/s]
100%|      | 30/30 [00:03<00:00,  8.09it/s]
100%|      | 30/30 [00:03<00:00,  8.10it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  7.97it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.10it/s]
100%|      | 30/30 [00:03<00:00,  8.04it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.16it/s]
100%|      | 30/30 [00:03<00:00,  8.16it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.08it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  7.96it/s]
100%|      | 30/30 [00:03<00:00,  8.06it/s]
100%|      | 30/30 [00:03<00:00,  7.94it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.07it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  7.99it/s]
100%|      | 30/30 [00:03<00:00,  8.10it/s]
100%|      | 30/30 [00:03<00:00,  8.07it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.08it/s]
100%|      | 30/30 [00:03<00:00,  8.05it/s]
Epoch 1/5
12/12 [==============================] - 34s 3s/step - loss: 0.0066 - accuracy:
1.0000
Epoch 2/5
12/12 [==============================] - 34s 3s/step - loss: 0.0055 - accuracy:
1.0000
Epoch 3/5
12/12 [==============================] - 34s 3s/step - loss: 0.0046 - accuracy:
1.0000
Epoch 4/5
12/12 [==============================] - 34s 3s/step - loss: 0.0042 - accuracy:
1.0000
Epoch 5/5
12/12 [==============================] - 34s 3s/step - loss: 0.0042 - accuracy:
1.0000
4/4 [==============================] - 2s 536ms/step - loss: 0.1566 - accuracy:
0.9556
Accuracy - None::  0.34555554389953613
```

```
Accuracy - jitter::  0.3311111032962799
Accuracy - scaling::  0.3311111032962799
Accuracy - rotation::  0.3333333432674408
Accuracy - permutation::  0.3333333432674408
Accuracy - magnitude_warp::  0.3333333432674408
Accuracy - time_warp::  0.3333333432674408
Accuracy - window_slice::  0.378888875246048
Accuracy - window_warp::  0.605555534362793
Accuracy - spawner::  0.5933333039283752
Accuracy - wdba::  0.9766666889190674
Accuracy - random_guided_warp::  0.9888888597488403
Accuracy - discriminative_guided_warp::  0.9555555582046509
```

mlp

[ ]:
```
model = get_model("mlp", input_shape, nb_class)
model.compile(optimizer=optm, loss='categorical_crossentropy',␣
 ↪metrics=['accuracy'])
method_apply_deep(model, x_train, y_train, x_test, y_test)
```

```
Model: "model_3"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_4 (InputLayer)        [(None, 128, 1)]          0

 flatten (Flatten)           (None, 128)               0

 dropout_1 (Dropout)         (None, 128)               0

 dense_3 (Dense)             (None, 500)               64500

 dropout_2 (Dropout)         (None, 500)               0

 dense_4 (Dense)             (None, 500)               250500

 dropout_3 (Dropout)         (None, 500)               0

 dense_5 (Dense)             (None, 500)               250500

 dropout_4 (Dropout)         (None, 500)               0

 dense_6 (Dense)             (None, 3)                 1503

=================================================================
Total params: 567,003
Trainable params: 567,003
Non-trainable params: 0
```

```
----------------------------------------------------------------
Epoch 1/5
1/1 [==============================] - 1s 530ms/step - loss: 1.0582 - accuracy:
0.3333
Epoch 2/5
1/1 [==============================] - 0s 13ms/step - loss: 1.0903 - accuracy:
0.4667
Epoch 3/5
1/1 [==============================] - 0s 19ms/step - loss: 1.0682 - accuracy:
0.3667
Epoch 4/5
1/1 [==============================] - 0s 16ms/step - loss: 1.0431 - accuracy:
0.4333
Epoch 5/5
1/1 [==============================] - 0s 14ms/step - loss: 1.0579 - accuracy:
0.3667
4/4 [==============================] - 0s 9ms/step - loss: 1.0537 - accuracy:
0.5000
Epoch 1/5
12/12 [==============================] - 1s 30ms/step - loss: 0.9821 - accuracy:
0.5607
Epoch 2/5
12/12 [==============================] - 0s 30ms/step - loss: 0.8094 - accuracy:
0.7417
Epoch 3/5
12/12 [==============================] - 0s 29ms/step - loss: 0.6171 - accuracy:
0.8427
Epoch 4/5
12/12 [==============================] - 0s 30ms/step - loss: 0.4395 - accuracy:
0.9023
Epoch 5/5
12/12 [==============================] - 0s 29ms/step - loss: 0.2928 - accuracy:
0.9423
4/4 [==============================] - 0s 8ms/step - loss: 0.3160 - accuracy:
0.8967
Epoch 1/5
12/12 [==============================] - 0s 31ms/step - loss: 0.1938 - accuracy:
0.9613
Epoch 2/5
12/12 [==============================] - 0s 30ms/step - loss: 0.1316 - accuracy:
0.9740
Epoch 3/5
12/12 [==============================] - 0s 29ms/step - loss: 0.0937 - accuracy:
0.9837
Epoch 4/5
12/12 [==============================] - 0s 30ms/step - loss: 0.0697 - accuracy:
0.9927
Epoch 5/5
```

```
12/12 [==============================] - 0s 29ms/step - loss: 0.0534 - accuracy:
0.9963
4/4 [==============================] - 0s 9ms/step - loss: 0.1998 - accuracy:
0.9189
Epoch 1/5
12/12 [==============================] - 0s 30ms/step - loss: 0.9516 - accuracy:
0.5847
Epoch 2/5
12/12 [==============================] - 0s 30ms/step - loss: 0.5226 - accuracy:
0.7573
Epoch 3/5
12/12 [==============================] - 0s 28ms/step - loss: 0.4219 - accuracy:
0.8500
Epoch 4/5
12/12 [==============================] - 0s 29ms/step - loss: 0.3436 - accuracy:
0.9000
Epoch 5/5
12/12 [==============================] - 0s 29ms/step - loss: 0.2821 - accuracy:
0.9343
4/4 [==============================] - 0s 8ms/step - loss: 0.2717 - accuracy:
0.8689
Epoch 1/5

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

12/12 [==============================] - 0s 29ms/step - loss: 1.0322 - accuracy:
0.6337
Epoch 2/5
12/12 [==============================] - 0s 29ms/step - loss: 0.7672 - accuracy:
0.6443
Epoch 3/5
12/12 [==============================] - 0s 30ms/step - loss: 0.6866 - accuracy:
0.6830
Epoch 4/5
12/12 [==============================] - 0s 28ms/step - loss: 0.6535 - accuracy:
0.6980
Epoch 5/5
12/12 [==============================] - 0s 28ms/step - loss: 0.6304 - accuracy:
0.6993
4/4 [==============================] - 0s 8ms/step - loss: 0.3755 - accuracy:
```

```
0.8800
Epoch 1/5
12/12 [==============================] - 0s 30ms/step - loss: 0.1303 - accuracy:
0.9950
Epoch 2/5
12/12 [==============================] - 0s 29ms/step - loss: 0.0723 - accuracy:
0.9977
Epoch 3/5
12/12 [==============================] - 0s 28ms/step - loss: 0.0479 - accuracy:
0.9967
Epoch 4/5
12/12 [==============================] - 0s 29ms/step - loss: 0.0363 - accuracy:
0.9980
Epoch 5/5
12/12 [==============================] - 0s 29ms/step - loss: 0.0289 - accuracy:
0.9990
4/4 [==============================] - 0s 8ms/step - loss: 0.2435 - accuracy:
0.8922
Epoch 1/5
12/12 [==============================] - 0s 30ms/step - loss: 0.0194 - accuracy:
0.9997
Epoch 2/5
12/12 [==============================] - 0s 30ms/step - loss: 0.0174 - accuracy:
0.9993
Epoch 3/5
12/12 [==============================] - 0s 30ms/step - loss: 0.0156 - accuracy:
0.9997
Epoch 4/5
12/12 [==============================] - 0s 30ms/step - loss: 0.0123 - accuracy:
1.0000
Epoch 5/5
12/12 [==============================] - 0s 29ms/step - loss: 0.0130 - accuracy:
0.9990
4/4 [==============================] - 0s 8ms/step - loss: 0.2570 - accuracy:
0.8889
Epoch 1/5
12/12 [==============================] - 0s 30ms/step - loss: 0.2900 - accuracy:
0.8893
Epoch 2/5
12/12 [==============================] - 0s 29ms/step - loss: 0.2275 - accuracy:
0.9130
Epoch 3/5
12/12 [==============================] - 0s 29ms/step - loss: 0.1664 - accuracy:
0.9423
Epoch 4/5
12/12 [==============================] - 0s 30ms/step - loss: 0.1379 - accuracy:
0.9483
Epoch 5/5
```

```
12/12 [==============================] - 0s 29ms/step - loss: 0.1102 - accuracy:
0.9643
4/4 [==============================] - 0s 10ms/step - loss: 0.1132 - accuracy:
0.9578
Epoch 1/5
12/12 [==============================] - 0s 29ms/step - loss: 0.2625 - accuracy:
0.9330
Epoch 2/5
12/12 [==============================] - 0s 29ms/step - loss: 0.2168 - accuracy:
0.9380
Epoch 3/5
12/12 [==============================] - 0s 30ms/step - loss: 0.1880 - accuracy:
0.9477
Epoch 4/5
12/12 [==============================] - 0s 29ms/step - loss: 0.1677 - accuracy:
0.9503
Epoch 5/5
12/12 [==============================] - 0s 29ms/step - loss: 0.1451 - accuracy:
0.9553
4/4 [==============================] - 0s 10ms/step - loss: 0.1350 - accuracy:
0.9456
```

```
100%|      | 30/30 [00:00<00:00, 96.67it/s]
100%|      | 30/30 [00:00<00:00, 100.66it/s]
100%|      | 30/30 [00:00<00:00, 108.89it/s]
100%|      | 30/30 [00:00<00:00, 103.75it/s]
100%|      | 30/30 [00:00<00:00, 99.80it/s]
100%|      | 30/30 [00:00<00:00, 106.16it/s]
100%|      | 30/30 [00:00<00:00, 102.03it/s]
100%|      | 30/30 [00:00<00:00, 103.05it/s]
100%|      | 30/30 [00:00<00:00, 108.71it/s]
100%|      | 30/30 [00:00<00:00, 105.98it/s]
100%|      | 30/30 [00:00<00:00, 102.30it/s]
100%|      | 30/30 [00:00<00:00, 97.75it/s]
100%|      | 30/30 [00:00<00:00, 101.34it/s]
100%|      | 30/30 [00:00<00:00, 106.75it/s]
100%|      | 30/30 [00:00<00:00, 97.19it/s]
100%|      | 30/30 [00:00<00:00, 102.84it/s]
100%|      | 30/30 [00:00<00:00, 101.98it/s]
100%|      | 30/30 [00:00<00:00, 91.11it/s]
100%|      | 30/30 [00:00<00:00, 101.75it/s]
100%|      | 30/30 [00:00<00:00, 105.43it/s]
100%|      | 30/30 [00:00<00:00, 99.09it/s]
100%|      | 30/30 [00:00<00:00, 107.46it/s]
100%|      | 30/30 [00:00<00:00, 109.35it/s]
100%|      | 30/30 [00:00<00:00, 110.54it/s]
100%|      | 30/30 [00:00<00:00, 103.87it/s]
100%|      | 30/30 [00:00<00:00, 101.57it/s]
```

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100%|      | 30/30 [00:00<00:00, 105.64it/s]
100%|      | 30/30 [00:00<00:00, 99.05it/s]
100%|      | 30/30 [00:00<00:00, 103.60it/s]
100%|      | 30/30 [00:00<00:00, 114.46it/s]
100%|      | 30/30 [00:00<00:00, 101.13it/s]
100%|      | 30/30 [00:00<00:00, 96.65it/s]
100%|      | 30/30 [00:00<00:00, 99.40it/s]
100%|      | 30/30 [00:00<00:00, 110.35it/s]
100%|      | 30/30 [00:00<00:00, 105.55it/s]
100%|      | 30/30 [00:00<00:00, 102.29it/s]
100%|      | 30/30 [00:00<00:00, 100.26it/s]
100%|      | 30/30 [00:00<00:00, 94.31it/s]
100%|      | 30/30 [00:00<00:00, 101.53it/s]
100%|      | 30/30 [00:00<00:00, 100.77it/s]
100%|      | 30/30 [00:00<00:00, 98.34it/s]
100%|      | 30/30 [00:00<00:00, 91.57it/s]
100%|      | 30/30 [00:00<00:00, 101.51it/s]
100%|      | 30/30 [00:00<00:00, 100.81it/s]
100%|      | 30/30 [00:00<00:00, 102.31it/s]
100%|      | 30/30 [00:00<00:00, 106.03it/s]
100%|      | 30/30 [00:00<00:00, 98.27it/s]
100%|      | 30/30 [00:00<00:00, 89.85it/s]
100%|      | 30/30 [00:00<00:00, 102.16it/s]
100%|      | 30/30 [00:00<00:00, 112.66it/s]
100%|      | 30/30 [00:00<00:00, 101.78it/s]
100%|      | 30/30 [00:00<00:00, 96.35it/s]
100%|      | 30/30 [00:00<00:00, 102.80it/s]
100%|      | 30/30 [00:00<00:00, 97.95it/s]
100%|      | 30/30 [00:00<00:00, 103.96it/s]
100%|      | 30/30 [00:00<00:00, 108.55it/s]
100%|      | 30/30 [00:00<00:00, 105.81it/s]
100%|      | 30/30 [00:00<00:00, 107.53it/s]
100%|      | 30/30 [00:00<00:00, 108.35it/s]
100%|      | 30/30 [00:00<00:00, 107.09it/s]
100%|      | 30/30 [00:00<00:00, 107.23it/s]
100%|      | 30/30 [00:00<00:00, 87.86it/s]
100%|      | 30/30 [00:00<00:00, 105.86it/s]
100%|      | 30/30 [00:00<00:00, 105.18it/s]
100%|      | 30/30 [00:00<00:00, 99.95it/s]
100%|      | 30/30 [00:00<00:00, 109.75it/s]
100%|      | 30/30 [00:00<00:00, 101.63it/s]
100%|      | 30/30 [00:00<00:00, 97.47it/s]
100%|      | 30/30 [00:00<00:00, 97.43it/s]
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100%|      | 30/30 [00:00<00:00, 107.31it/s]
100%|      | 30/30 [00:00<00:00, 101.96it/s]
100%|      | 30/30 [00:00<00:00, 106.58it/s]
100%|      | 30/30 [00:00<00:00, 108.37it/s]
```

```
100%|      | 30/30 [00:00<00:00, 104.30it/s]
100%|      | 30/30 [00:00<00:00, 96.75it/s]
100%|      | 30/30 [00:00<00:00, 110.27it/s]
100%|      | 30/30 [00:00<00:00, 103.36it/s]
100%|      | 30/30 [00:00<00:00, 107.98it/s]
100%|      | 30/30 [00:00<00:00, 110.69it/s]
100%|      | 30/30 [00:00<00:00, 106.46it/s]
100%|      | 30/30 [00:00<00:00, 96.59it/s]
100%|      | 30/30 [00:00<00:00, 110.52it/s]
100%|      | 30/30 [00:00<00:00, 94.56it/s]
100%|      | 30/30 [00:00<00:00, 93.13it/s]
100%|      | 30/30 [00:00<00:00, 107.76it/s]
100%|      | 30/30 [00:00<00:00, 100.49it/s]
100%|      | 30/30 [00:00<00:00, 108.02it/s]
100%|      | 30/30 [00:00<00:00, 101.24it/s]
100%|      | 30/30 [00:00<00:00, 103.40it/s]
100%|      | 30/30 [00:00<00:00, 105.54it/s]
100%|      | 30/30 [00:00<00:00, 100.23it/s]
100%|      | 30/30 [00:00<00:00, 103.07it/s]
100%|      | 30/30 [00:00<00:00, 95.19it/s]
100%|      | 30/30 [00:00<00:00, 91.75it/s]
100%|      | 30/30 [00:00<00:00, 79.65it/s]
100%|      | 30/30 [00:00<00:00, 93.77it/s]
100%|      | 30/30 [00:00<00:00, 99.52it/s]
100%|      | 30/30 [00:00<00:00, 80.72it/s]

Epoch 1/5
12/12 [==============================] - 0s 29ms/step - loss: 0.6772 - accuracy:
0.7877
Epoch 2/5
12/12 [==============================] - 0s 31ms/step - loss: 0.5017 - accuracy:
0.8033
Epoch 3/5
12/12 [==============================] - 0s 30ms/step - loss: 0.4102 - accuracy:
0.8270
Epoch 4/5
12/12 [==============================] - 0s 29ms/step - loss: 0.3789 - accuracy:
0.8447
Epoch 5/5
12/12 [==============================] - 0s 31ms/step - loss: 0.3739 - accuracy:
0.8410
4/4 [==============================] - 0s 8ms/step - loss: 0.1757 - accuracy:
0.9478

100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
```

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100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.75it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.89it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.87it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.75it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:08<00:00,  3.69it/s]
100%|      | 30/30 [00:08<00:00,  3.70it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:08<00:00,  3.73it/s]
100%|      | 30/30 [00:08<00:00,  3.67it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:08<00:00,  3.73it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:07<00:00,  3.75it/s]
100%|      | 30/30 [00:08<00:00,  3.71it/s]
100%|      | 30/30 [00:08<00:00,  3.75it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:08<00:00,  3.73it/s]
100%|      | 30/30 [00:08<00:00,  3.72it/s]
100%|      | 30/30 [00:08<00:00,  3.62it/s]
100%|      | 30/30 [00:08<00:00,  3.62it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:08<00:00,  3.73it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:08<00:00,  3.71it/s]
100%|      | 30/30 [00:08<00:00,  3.71it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:08<00:00,  3.67it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:08<00:00,  3.53it/s]
100%|      | 30/30 [00:08<00:00,  3.66it/s]
100%|      | 30/30 [00:08<00:00,  3.66it/s]
100%|      | 30/30 [00:08<00:00,  3.61it/s]
100%|      | 30/30 [00:08<00:00,  3.68it/s]
100%|      | 30/30 [00:08<00:00,  3.70it/s]
100%|      | 30/30 [00:08<00:00,  3.64it/s]
100%|      | 30/30 [00:08<00:00,  3.66it/s]
100%|      | 30/30 [00:08<00:00,  3.65it/s]
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.62it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:08<00:00,  3.71it/s]
100%|      | 30/30 [00:08<00:00,  3.66it/s]
100%|      | 30/30 [00:08<00:00,  3.60it/s]
100%|      | 30/30 [00:08<00:00,  3.69it/s]
100%|      | 30/30 [00:08<00:00,  3.60it/s]

Epoch 1/5
```

```
 3/12 [======>…] - ETA: 0s - loss: 0.0358 - accuracy:
1.0000


12/12 [==============================] - 0s 30ms/step - loss: 0.0322 - accuracy:
0.9990
Epoch 2/5
12/12 [==============================] - 0s 30ms/step - loss: 0.0214 - accuracy:
1.0000
Epoch 3/5
12/12 [==============================] - 0s 31ms/step - loss: 0.0151 - accuracy:
0.9997
Epoch 4/5
12/12 [==============================] - 0s 31ms/step - loss: 0.0111 - accuracy:
1.0000
Epoch 5/5
12/12 [==============================] - 0s 31ms/step - loss: 0.0089 - accuracy:
1.0000
4/4 [==============================] - 0s 9ms/step - loss: 0.1780 - accuracy:
0.9278
100%|      | 30/30 [00:00<00:00, 86.90it/s]
100%|      | 30/30 [00:00<00:00, 80.90it/s]
100%|      | 30/30 [00:00<00:00, 93.44it/s]
100%|      | 30/30 [00:00<00:00, 99.39it/s]
100%|      | 30/30 [00:00<00:00, 103.34it/s]
100%|      | 30/30 [00:00<00:00, 85.47it/s]
100%|      | 30/30 [00:00<00:00, 94.55it/s]
100%|      | 30/30 [00:00<00:00, 94.49it/s]
100%|      | 30/30 [00:00<00:00, 86.97it/s]
100%|      | 30/30 [00:00<00:00, 86.18it/s]
100%|      | 30/30 [00:00<00:00, 97.26it/s]
100%|      | 30/30 [00:00<00:00, 97.29it/s]
100%|      | 30/30 [00:00<00:00, 93.90it/s]
100%|      | 30/30 [00:00<00:00, 103.08it/s]
100%|      | 30/30 [00:00<00:00, 92.88it/s]
100%|      | 30/30 [00:00<00:00, 94.10it/s]
100%|      | 30/30 [00:00<00:00, 93.19it/s]
100%|      | 30/30 [00:00<00:00, 81.08it/s]
100%|      | 30/30 [00:00<00:00, 92.23it/s]
100%|      | 30/30 [00:00<00:00, 100.03it/s]
100%|      | 30/30 [00:00<00:00, 96.46it/s]
100%|      | 30/30 [00:00<00:00, 84.02it/s]
100%|      | 30/30 [00:00<00:00, 102.57it/s]
100%|      | 30/30 [00:00<00:00, 95.28it/s]
100%|      | 30/30 [00:00<00:00, 92.97it/s]
100%|      | 30/30 [00:00<00:00, 98.52it/s]
100%|      | 30/30 [00:00<00:00, 98.67it/s]
```

```
100%|      | 30/30 [00:00<00:00, 86.41it/s]
100%|      | 30/30 [00:00<00:00, 91.75it/s]
100%|      | 30/30 [00:00<00:00, 86.78it/s]
100%|      | 30/30 [00:00<00:00, 98.64it/s]
100%|      | 30/30 [00:00<00:00, 86.82it/s]
100%|      | 30/30 [00:00<00:00, 86.16it/s]
100%|      | 30/30 [00:00<00:00, 92.36it/s]
100%|      | 30/30 [00:00<00:00, 93.61it/s]
100%|      | 30/30 [00:00<00:00, 101.16it/s]
100%|      | 30/30 [00:00<00:00, 90.73it/s]
100%|      | 30/30 [00:00<00:00, 98.67it/s]
100%|      | 30/30 [00:00<00:00, 89.22it/s]
100%|      | 30/30 [00:00<00:00, 89.16it/s]
100%|      | 30/30 [00:00<00:00, 98.17it/s]
100%|      | 30/30 [00:00<00:00, 100.87it/s]
100%|      | 30/30 [00:00<00:00, 100.33it/s]
100%|      | 30/30 [00:00<00:00, 95.59it/s]
100%|      | 30/30 [00:00<00:00, 101.32it/s]
100%|      | 30/30 [00:00<00:00, 83.65it/s]
100%|      | 30/30 [00:00<00:00, 88.06it/s]
100%|      | 30/30 [00:00<00:00, 100.31it/s]
100%|      | 30/30 [00:00<00:00, 100.01it/s]
100%|      | 30/30 [00:00<00:00, 92.79it/s]
100%|      | 30/30 [00:00<00:00, 85.98it/s]
100%|      | 30/30 [00:00<00:00, 93.64it/s]
100%|      | 30/30 [00:00<00:00, 99.22it/s]
100%|      | 30/30 [00:00<00:00, 94.15it/s]
100%|      | 30/30 [00:00<00:00, 95.16it/s]
100%|      | 30/30 [00:00<00:00, 92.59it/s]
100%|      | 30/30 [00:00<00:00, 94.32it/s]
100%|      | 30/30 [00:00<00:00, 94.39it/s]
100%|      | 30/30 [00:00<00:00, 98.65it/s]
100%|      | 30/30 [00:00<00:00, 108.48it/s]
100%|      | 30/30 [00:00<00:00, 94.86it/s]
100%|      | 30/30 [00:00<00:00, 89.66it/s]
100%|      | 30/30 [00:00<00:00, 88.85it/s]
100%|      | 30/30 [00:00<00:00, 87.73it/s]
100%|      | 30/30 [00:00<00:00, 97.49it/s]
100%|      | 30/30 [00:00<00:00, 95.80it/s]
100%|      | 30/30 [00:00<00:00, 99.51it/s]
100%|      | 30/30 [00:00<00:00, 105.45it/s]
100%|      | 30/30 [00:00<00:00, 92.68it/s]
100%|      | 30/30 [00:00<00:00, 96.00it/s]
100%|      | 30/30 [00:00<00:00, 102.90it/s]
100%|      | 30/30 [00:00<00:00, 98.88it/s]
100%|      | 30/30 [00:00<00:00, 89.20it/s]
100%|      | 30/30 [00:00<00:00, 99.58it/s]
100%|      | 30/30 [00:00<00:00, 102.78it/s]
```

```
100%|      | 30/30 [00:00<00:00, 97.79it/s]
100%|      | 30/30 [00:00<00:00, 100.15it/s]
100%|      | 30/30 [00:00<00:00, 96.49it/s]
100%|      | 30/30 [00:00<00:00, 90.34it/s]
100%|      | 30/30 [00:00<00:00, 98.29it/s]
100%|      | 30/30 [00:00<00:00, 105.33it/s]
100%|      | 30/30 [00:00<00:00, 98.41it/s]
100%|      | 30/30 [00:00<00:00, 96.64it/s]
100%|      | 30/30 [00:00<00:00, 99.81it/s]
100%|      | 30/30 [00:00<00:00, 93.02it/s]
100%|      | 30/30 [00:00<00:00, 97.07it/s]
100%|      | 30/30 [00:00<00:00, 103.06it/s]
100%|      | 30/30 [00:00<00:00, 90.33it/s]
100%|      | 30/30 [00:00<00:00, 103.42it/s]
100%|      | 30/30 [00:00<00:00, 99.65it/s]
100%|      | 30/30 [00:00<00:00, 87.63it/s]
100%|      | 30/30 [00:00<00:00, 84.18it/s]
100%|      | 30/30 [00:00<00:00, 100.05it/s]
100%|      | 30/30 [00:00<00:00, 100.72it/s]
100%|      | 30/30 [00:00<00:00, 88.18it/s]
100%|      | 30/30 [00:00<00:00, 94.95it/s]
100%|      | 30/30 [00:00<00:00, 91.57it/s]
100%|      | 30/30 [00:00<00:00, 95.90it/s]
100%|      | 30/30 [00:00<00:00, 97.99it/s]

Epoch 1/5
 1/12 [=>…] - ETA: 0s - loss: 0.1543 - accuracy:
0.9375


12/12 [==============================] - 0s 31ms/step - loss: 0.1860 - accuracy:
0.9277
Epoch 2/5
12/12 [==============================] - 0s 30ms/step - loss: 0.1654 - accuracy:
0.9350
Epoch 3/5
12/12 [==============================] - 0s 30ms/step - loss: 0.1518 - accuracy:
0.9473
Epoch 4/5
12/12 [==============================] - 0s 31ms/step - loss: 0.1294 - accuracy:
0.9580
Epoch 5/5
12/12 [==============================] - 0s 30ms/step - loss: 0.1229 - accuracy:
0.9580
4/4 [==============================] - 0s 9ms/step - loss: 0.1304 - accuracy:
0.9456

100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.09it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.00it/s]
100%|      | 30/30 [00:03<00:00,  8.07it/s]
100%|      | 30/30 [00:03<00:00,  7.93it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.30it/s]
100%|      | 30/30 [00:03<00:00,  8.01it/s]
100%|      | 30/30 [00:03<00:00,  8.03it/s]
100%|      | 30/30 [00:03<00:00,  7.91it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  7.92it/s]
100%|      | 30/30 [00:03<00:00,  8.08it/s]
100%|      | 30/30 [00:03<00:00,  8.02it/s]
100%|      | 30/30 [00:03<00:00,  7.65it/s]
100%|      | 30/30 [00:03<00:00,  7.98it/s]
100%|      | 30/30 [00:03<00:00,  7.83it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.09it/s]
100%|      | 30/30 [00:03<00:00,  8.05it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  7.94it/s]
100%|      | 30/30 [00:03<00:00,  8.10it/s]
100%|      | 30/30 [00:03<00:00,  8.06it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  7.92it/s]
100%|      | 30/30 [00:03<00:00,  8.05it/s]
100%|      | 30/30 [00:03<00:00,  7.88it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.03it/s]
100%|      | 30/30 [00:03<00:00,  7.99it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.00it/s]
100%|      | 30/30 [00:03<00:00,  7.81it/s]
100%|      | 30/30 [00:03<00:00,  8.14it/s]
100%|      | 30/30 [00:03<00:00,  7.84it/s]
100%|      | 30/30 [00:03<00:00,  8.16it/s]
100%|      | 30/30 [00:03<00:00,  8.08it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  7.81it/s]
100%|      | 30/30 [00:03<00:00,  7.94it/s]
100%|      | 30/30 [00:03<00:00,  7.90it/s]
100%|      | 30/30 [00:03<00:00,  8.02it/s]
100%|      | 30/30 [00:03<00:00,  8.03it/s]
100%|      | 30/30 [00:03<00:00,  7.84it/s]
100%|      | 30/30 [00:03<00:00,  8.09it/s]
100%|      | 30/30 [00:03<00:00,  8.09it/s]
100%|      | 30/30 [00:03<00:00,  7.97it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  7.93it/s]
100%|      | 30/30 [00:03<00:00,  7.89it/s]
100%|      | 30/30 [00:03<00:00,  7.69it/s]
100%|      | 30/30 [00:03<00:00,  7.76it/s]
100%|      | 30/30 [00:04<00:00,  7.42it/s]
100%|      | 30/30 [00:04<00:00,  7.37it/s]
100%|      | 30/30 [00:04<00:00,  6.97it/s]
100%|      | 30/30 [00:03<00:00,  7.64it/s]
100%|      | 30/30 [00:04<00:00,  7.24it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.16it/s]
100%|      | 30/30 [00:04<00:00,  7.37it/s]
100%|      | 30/30 [00:04<00:00,  7.45it/s]
100%|      | 30/30 [00:04<00:00,  7.35it/s]
100%|      | 30/30 [00:04<00:00,  7.17it/s]
100%|      | 30/30 [00:03<00:00,  7.66it/s]
100%|      | 30/30 [00:03<00:00,  7.62it/s]
100%|      | 30/30 [00:04<00:00,  7.15it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:03<00:00,  7.73it/s]
100%|      | 30/30 [00:03<00:00,  7.72it/s]
100%|      | 30/30 [00:04<00:00,  7.28it/s]
100%|      | 30/30 [00:03<00:00,  7.86it/s]
100%|      | 30/30 [00:04<00:00,  7.30it/s]
100%|      | 30/30 [00:04<00:00,  7.23it/s]
100%|      | 30/30 [00:04<00:00,  6.94it/s]
100%|      | 30/30 [00:04<00:00,  7.44it/s]
100%|      | 30/30 [00:04<00:00,  7.19it/s]
100%|      | 30/30 [00:04<00:00,  7.39it/s]
100%|      | 30/30 [00:04<00:00,  7.31it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:04<00:00,  7.17it/s]
100%|      | 30/30 [00:04<00:00,  7.16it/s]
100%|      | 30/30 [00:03<00:00,  7.54it/s]
100%|      | 30/30 [00:04<00:00,  7.33it/s]
100%|      | 30/30 [00:04<00:00,  7.24it/s]
100%|      | 30/30 [00:04<00:00,  7.36it/s]
100%|      | 30/30 [00:04<00:00,  7.41it/s]
100%|      | 30/30 [00:03<00:00,  7.58it/s]
100%|      | 30/30 [00:03<00:00,  7.59it/s]
100%|      | 30/30 [00:04<00:00,  7.40it/s]
100%|      | 30/30 [00:03<00:00,  7.68it/s]
100%|      | 30/30 [00:04<00:00,  7.49it/s]
100%|      | 30/30 [00:03<00:00,  7.96it/s]
100%|      | 30/30 [00:03<00:00,  7.51it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
```

```
100%|      | 30/30 [00:03<00:00,  7.75it/s]

Epoch 1/5
12/12 [==============================] - 0s 30ms/step - loss: 0.1167 - accuracy:
0.9583
Epoch 2/5
12/12 [==============================] - 0s 30ms/step - loss: 0.1142 - accuracy:
0.9610
Epoch 3/5
12/12 [==============================] - 0s 31ms/step - loss: 0.1050 - accuracy:
0.9623
Epoch 4/5
12/12 [==============================] - 0s 30ms/step - loss: 0.1082 - accuracy:
0.9617
Epoch 5/5
12/12 [==============================] - 0s 29ms/step - loss: 0.0998 - accuracy:
0.9690
4/4 [==============================] - 0s 9ms/step - loss: 0.1218 - accuracy:
0.9489
Accuracy - None::  0.5
Accuracy - jitter::  0.8966666460037231
Accuracy - scaling::  0.9188888669013977
Accuracy - rotation::  0.8688889145851135
Accuracy - permutation::  0.8799999952316284
Accuracy - magnitude_warp::  0.8922222256660461
Accuracy - time_warp::  0.8888888955116272
Accuracy - window_slice::  0.9577777981758118
Accuracy - window_warp::  0.945555567741394
Accuracy - spawner::  0.9477777481079102
Accuracy - wdba::  0.9277777671813965
Accuracy - random_guided_warp::  0.945555567741394
Accuracy - discriminative_guided_warp::  0.948888897895813
```

lenet

```
[ ]: model = get_model("lenet", input_shape, nb_class)
     model.compile(optimizer=optm, loss='categorical_crossentropy',␣
      ↪metrics=['accuracy'])
     method_apply_deep(model, x_train, y_train, x_test, y_test)
```

```
pooling layers: 4
Model: "model_4"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_5 (InputLayer)        [(None, 128, 1)]          0

 conv1d_14 (Conv1D)          (None, 128, 6)            24
```

```
 max_pooling1d (MaxPooling1D  (None, 64, 6)            0
 )

 conv1d_15 (Conv1D)          (None, 64, 16)            304

 max_pooling1d_1 (MaxPooling  (None, 32, 16)           0
 1D)

 conv1d_16 (Conv1D)          (None, 32, 26)            1274

 max_pooling1d_2 (MaxPooling  (None, 16, 26)           0
 1D)

 conv1d_17 (Conv1D)          (None, 16, 36)            2844

 max_pooling1d_3 (MaxPooling  (None, 8, 36)            0
 1D)

 flatten_1 (Flatten)         (None, 288)               0

 dense_7 (Dense)             (None, 120)               34680

 dropout_5 (Dropout)         (None, 120)               0

 dense_8 (Dense)             (None, 84)                10164

 dropout_6 (Dropout)         (None, 84)                0

 dense_9 (Dense)             (None, 3)                 255

=================================================================
Total params: 49,545
Trainable params: 49,545
Non-trainable params: 0
_________________________________________________________________
Epoch 1/5
1/1 [==============================] - 1s 847ms/step - loss: 1.7658 - accuracy:
0.5000
Epoch 2/5
1/1 [==============================] - 0s 15ms/step - loss: 1.6670 - accuracy:
0.4000
Epoch 3/5
1/1 [==============================] - 0s 11ms/step - loss: 1.4901 - accuracy:
0.4667
Epoch 4/5
1/1 [==============================] - 0s 17ms/step - loss: 1.2415 - accuracy:
0.4000
Epoch 5/5
```

```
1/1 [==============================] - 0s 12ms/step - loss: 1.3870 - accuracy:
0.3333
4/4 [==============================] - 0s 14ms/step - loss: 1.0468 - accuracy:
0.3633
Epoch 1/5
12/12 [==============================] - 1s 36ms/step - loss: 1.0399 - accuracy:
0.4867
Epoch 2/5
12/12 [==============================] - 0s 34ms/step - loss: 0.8190 - accuracy:
0.6637
Epoch 3/5
12/12 [==============================] - 0s 37ms/step - loss: 0.6238 - accuracy:
0.7723
Epoch 4/5
12/12 [==============================] - 0s 36ms/step - loss: 0.4156 - accuracy:
0.8667
Epoch 5/5
12/12 [==============================] - 0s 37ms/step - loss: 0.2914 - accuracy:
0.9040
4/4 [==============================] - 0s 12ms/step - loss: 0.2475 - accuracy:
0.8933
Epoch 1/5
12/12 [==============================] - 0s 36ms/step - loss: 0.1912 - accuracy:
0.9410
Epoch 2/5
12/12 [==============================] - 0s 38ms/step - loss: 0.1436 - accuracy:
0.9570
Epoch 3/5
12/12 [==============================] - 0s 36ms/step - loss: 0.1075 - accuracy:
0.9643
Epoch 4/5
12/12 [==============================] - 0s 37ms/step - loss: 0.0775 - accuracy:
0.9813
Epoch 5/5
12/12 [==============================] - 0s 37ms/step - loss: 0.0633 - accuracy:
0.9840
4/4 [==============================] - 0s 13ms/step - loss: 0.2600 - accuracy:
0.8989
Epoch 1/5
12/12 [==============================] - 0s 36ms/step - loss: 1.4757 - accuracy:
0.6050
Epoch 2/5
12/12 [==============================] - 0s 35ms/step - loss: 0.7686 - accuracy:
0.6620
Epoch 3/5
12/12 [==============================] - 0s 38ms/step - loss: 0.5758 - accuracy:
0.8027
Epoch 4/5
```

```
12/12 [==============================] - 0s 35ms/step - loss: 0.4444 - accuracy:
0.8533
Epoch 5/5
12/12 [==============================] - 0s 35ms/step - loss: 0.3360 - accuracy:
0.8867
4/4 [==============================] - 0s 13ms/step - loss: 0.5001 - accuracy:
0.8400

/usr/local/lib/python3.7/dist-packages/numpy/core/_asarray.py:83:
VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences
(which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths
or shapes) is deprecated. If you meant to do this, you must specify
'dtype=object' when creating the ndarray
  return array(a, dtype, copy=False, order=order)
<string>:6: VisibleDeprecationWarning: Creating an ndarray from ragged nested
sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
different lengths or shapes) is deprecated. If you meant to do this, you must
specify 'dtype=object' when creating the ndarray

Epoch 1/5
12/12 [==============================] - 0s 34ms/step - loss: 1.0886 - accuracy:
0.5987
Epoch 2/5
12/12 [==============================] - 0s 35ms/step - loss: 0.7954 - accuracy:
0.6267
Epoch 3/5
12/12 [==============================] - 0s 34ms/step - loss: 0.7236 - accuracy:
0.6650
Epoch 4/5
12/12 [==============================] - 0s 34ms/step - loss: 0.6693 - accuracy:
0.7073
Epoch 5/5
12/12 [==============================] - 0s 36ms/step - loss: 0.6078 - accuracy:
0.7417
4/4 [==============================] - 0s 13ms/step - loss: 0.3754 - accuracy:
0.8811
Epoch 1/5
12/12 [==============================] - 0s 36ms/step - loss: 0.1861 - accuracy:
0.9620
Epoch 2/5
12/12 [==============================] - 0s 35ms/step - loss: 0.1150 - accuracy:
0.9757
Epoch 3/5
12/12 [==============================] - 0s 36ms/step - loss: 0.0827 - accuracy:
0.9787
Epoch 4/5
12/12 [==============================] - 0s 34ms/step - loss: 0.0570 - accuracy:
0.9880
Epoch 5/5
```

```
12/12 [==============================] - 0s 35ms/step - loss: 0.0456 - accuracy:
0.9910
4/4 [==============================] - 0s 13ms/step - loss: 0.3271 - accuracy:
0.9000
Epoch 1/5
12/12 [==============================] - 0s 34ms/step - loss: 0.0250 - accuracy:
0.9977
Epoch 2/5
12/12 [==============================] - 0s 33ms/step - loss: 0.0216 - accuracy:
0.9960
Epoch 3/5
12/12 [==============================] - 0s 35ms/step - loss: 0.0195 - accuracy:
0.9963
Epoch 4/5
12/12 [==============================] - 0s 33ms/step - loss: 0.0182 - accuracy:
0.9973
Epoch 5/5
12/12 [==============================] - 0s 36ms/step - loss: 0.0184 - accuracy:
0.9970
4/4 [==============================] - 0s 12ms/step - loss: 0.3552 - accuracy:
0.9056
Epoch 1/5
12/12 [==============================] - 0s 33ms/step - loss: 0.1316 - accuracy:
0.9543
Epoch 2/5
12/12 [==============================] - 0s 35ms/step - loss: 0.0893 - accuracy:
0.9703
Epoch 3/5
12/12 [==============================] - 0s 34ms/step - loss: 0.0509 - accuracy:
0.9867
Epoch 4/5
12/12 [==============================] - 0s 37ms/step - loss: 0.0402 - accuracy:
0.9897
Epoch 5/5
12/12 [==============================] - 0s 35ms/step - loss: 0.0423 - accuracy:
0.9880
4/4 [==============================] - 0s 13ms/step - loss: 0.1678 - accuracy:
0.9467
Epoch 1/5
12/12 [==============================] - 0s 35ms/step - loss: 0.0767 - accuracy:
0.9767
Epoch 2/5
12/12 [==============================] - 0s 35ms/step - loss: 0.0502 - accuracy:
0.9870
Epoch 3/5
12/12 [==============================] - 0s 36ms/step - loss: 0.0370 - accuracy:
0.9903
Epoch 4/5
```

```
12/12 [==============================] - 0s 37ms/step - loss: 0.0309 - accuracy:
0.9923
Epoch 5/5
12/12 [==============================] - 0s 36ms/step - loss: 0.0339 - accuracy:
0.9910
4/4 [==============================] - 0s 14ms/step - loss: 0.1742 - accuracy:
0.9500
```

```
100%|      | 30/30 [00:00<00:00, 102.75it/s]
100%|      | 30/30 [00:00<00:00, 104.43it/s]
100%|      | 30/30 [00:00<00:00, 96.55it/s]
100%|      | 30/30 [00:00<00:00, 104.90it/s]
100%|      | 30/30 [00:00<00:00, 102.73it/s]
100%|      | 30/30 [00:00<00:00, 87.66it/s]
100%|      | 30/30 [00:00<00:00, 94.15it/s]
100%|      | 30/30 [00:00<00:00, 102.27it/s]
100%|      | 30/30 [00:00<00:00, 89.25it/s]
100%|      | 30/30 [00:00<00:00, 99.56it/s]
100%|      | 30/30 [00:00<00:00, 101.06it/s]
100%|      | 30/30 [00:00<00:00, 103.91it/s]
100%|      | 30/30 [00:00<00:00, 99.56it/s]
100%|      | 30/30 [00:00<00:00, 89.95it/s]
100%|      | 30/30 [00:00<00:00, 95.04it/s]
100%|      | 30/30 [00:00<00:00, 93.95it/s]
100%|      | 30/30 [00:00<00:00, 74.76it/s]
100%|      | 30/30 [00:00<00:00, 82.07it/s]
100%|      | 30/30 [00:00<00:00, 86.62it/s]
100%|      | 30/30 [00:00<00:00, 76.53it/s]
100%|      | 30/30 [00:00<00:00, 83.81it/s]
100%|      | 30/30 [00:00<00:00, 81.84it/s]
100%|      | 30/30 [00:00<00:00, 84.87it/s]
100%|      | 30/30 [00:00<00:00, 86.32it/s]
100%|      | 30/30 [00:00<00:00, 90.88it/s]
100%|      | 30/30 [00:00<00:00, 95.07it/s]
100%|      | 30/30 [00:00<00:00, 83.17it/s]
100%|      | 30/30 [00:00<00:00, 106.93it/s]
100%|      | 30/30 [00:00<00:00, 100.35it/s]
100%|      | 30/30 [00:00<00:00, 100.00it/s]
100%|      | 30/30 [00:00<00:00, 96.10it/s]
100%|      | 30/30 [00:00<00:00, 95.55it/s]
100%|      | 30/30 [00:00<00:00, 96.60it/s]
100%|      | 30/30 [00:00<00:00, 93.51it/s]
100%|      | 30/30 [00:00<00:00, 98.97it/s]
100%|      | 30/30 [00:00<00:00, 92.95it/s]
100%|      | 30/30 [00:00<00:00, 107.03it/s]
100%|      | 30/30 [00:00<00:00, 103.75it/s]
100%|      | 30/30 [00:00<00:00, 76.02it/s]
100%|      | 30/30 [00:00<00:00, 86.44it/s]
```

```
100%|      | 30/30 [00:00<00:00, 102.26it/s]
100%|      | 30/30 [00:00<00:00, 90.37it/s]
100%|      | 30/30 [00:00<00:00, 80.35it/s]
100%|      | 30/30 [00:00<00:00, 91.12it/s]
100%|      | 30/30 [00:00<00:00, 86.60it/s]
100%|      | 30/30 [00:00<00:00, 100.49it/s]
100%|      | 30/30 [00:00<00:00, 97.65it/s]
100%|      | 30/30 [00:00<00:00, 101.64it/s]
100%|      | 30/30 [00:00<00:00, 96.61it/s]
100%|      | 30/30 [00:00<00:00, 100.62it/s]
100%|      | 30/30 [00:00<00:00, 90.32it/s]
100%|      | 30/30 [00:00<00:00, 88.55it/s]
100%|      | 30/30 [00:00<00:00, 87.44it/s]
100%|      | 30/30 [00:00<00:00, 98.09it/s]
100%|      | 30/30 [00:00<00:00, 105.97it/s]
100%|      | 30/30 [00:00<00:00, 91.48it/s]
100%|      | 30/30 [00:00<00:00, 99.86it/s]
100%|      | 30/30 [00:00<00:00, 98.01it/s]
100%|      | 30/30 [00:00<00:00, 96.83it/s]
100%|      | 30/30 [00:00<00:00, 103.16it/s]
100%|      | 30/30 [00:00<00:00, 100.05it/s]
100%|      | 30/30 [00:00<00:00, 101.48it/s]
100%|      | 30/30 [00:00<00:00, 102.18it/s]
100%|      | 30/30 [00:00<00:00, 108.67it/s]
100%|      | 30/30 [00:00<00:00, 96.59it/s]
100%|      | 30/30 [00:00<00:00, 105.25it/s]
100%|      | 30/30 [00:00<00:00, 102.02it/s]
100%|      | 30/30 [00:00<00:00, 101.51it/s]
100%|      | 30/30 [00:00<00:00, 92.02it/s]
100%|      | 30/30 [00:00<00:00, 100.47it/s]
100%|      | 30/30 [00:00<00:00, 94.66it/s]
100%|      | 30/30 [00:00<00:00, 97.62it/s]
100%|      | 30/30 [00:00<00:00, 92.70it/s]
100%|      | 30/30 [00:00<00:00, 102.41it/s]
100%|      | 30/30 [00:00<00:00, 98.79it/s]
100%|      | 30/30 [00:00<00:00, 92.50it/s]
100%|      | 30/30 [00:00<00:00, 91.51it/s]
100%|      | 30/30 [00:00<00:00, 104.90it/s]
100%|      | 30/30 [00:00<00:00, 99.84it/s]
100%|      | 30/30 [00:00<00:00, 98.19it/s]
100%|      | 30/30 [00:00<00:00, 99.89it/s]
100%|      | 30/30 [00:00<00:00, 95.79it/s]
100%|      | 30/30 [00:00<00:00, 105.57it/s]
100%|      | 30/30 [00:00<00:00, 91.60it/s]
100%|      | 30/30 [00:00<00:00, 101.25it/s]
100%|      | 30/30 [00:00<00:00, 100.71it/s]
100%|      | 30/30 [00:00<00:00, 87.21it/s]
100%|      | 30/30 [00:00<00:00, 107.83it/s]
```

```
100%|      | 30/30 [00:00<00:00, 85.33it/s]
100%|      | 30/30 [00:00<00:00, 88.66it/s]
100%|      | 30/30 [00:00<00:00, 92.73it/s]
100%|      | 30/30 [00:00<00:00, 97.33it/s]
100%|      | 30/30 [00:00<00:00, 97.69it/s]
100%|      | 30/30 [00:00<00:00, 83.82it/s]
100%|      | 30/30 [00:00<00:00, 94.37it/s]
100%|      | 30/30 [00:00<00:00, 101.01it/s]
100%|      | 30/30 [00:00<00:00, 99.42it/s]
100%|      | 30/30 [00:00<00:00, 89.78it/s]
100%|      | 30/30 [00:00<00:00, 92.01it/s]

Epoch 1/5
12/12 [==============================] - 0s 39ms/step - loss: 0.6703 - accuracy:
0.8077
Epoch 2/5
12/12 [==============================] - 0s 39ms/step - loss: 0.4459 - accuracy:
0.8330
Epoch 3/5
12/12 [==============================] - 0s 39ms/step - loss: 0.3873 - accuracy:
0.8477
Epoch 4/5
12/12 [==============================] - 0s 35ms/step - loss: 0.3577 - accuracy:
0.8623
Epoch 5/5
12/12 [==============================] - 0s 38ms/step - loss: 0.3332 - accuracy:
0.8647
4/4 [==============================] - 0s 14ms/step - loss: 0.1030 - accuracy:
0.9700

100%|      | 30/30 [00:08<00:00,  3.45it/s]
100%|      | 30/30 [00:08<00:00,  3.61it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.64it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.50it/s]
100%|      | 30/30 [00:08<00:00,  3.39it/s]
100%|      | 30/30 [00:08<00:00,  3.41it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
100%|      | 30/30 [00:08<00:00,  3.45it/s]
100%|      | 30/30 [00:08<00:00,  3.34it/s]
100%|      | 30/30 [00:08<00:00,  3.44it/s]
100%|      | 30/30 [00:08<00:00,  3.71it/s]
100%|      | 30/30 [00:08<00:00,  3.67it/s]
100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:08<00:00,  3.68it/s]
100%|      | 30/30 [00:08<00:00,  3.48it/s]
100%|      | 30/30 [00:08<00:00,  3.52it/s]
```

```
100%|      | 30/30 [00:08<00:00,  3.58it/s]
100%|      | 30/30 [00:08<00:00,  3.60it/s]
100%|      | 30/30 [00:08<00:00,  3.47it/s]
100%|      | 30/30 [00:08<00:00,  3.44it/s]
100%|      | 30/30 [00:09<00:00,  3.32it/s]
100%|      | 30/30 [00:08<00:00,  3.40it/s]
100%|      | 30/30 [00:09<00:00,  3.32it/s]
100%|      | 30/30 [00:08<00:00,  3.55it/s]
100%|      | 30/30 [00:08<00:00,  3.43it/s]
100%|      | 30/30 [00:08<00:00,  3.62it/s]
100%|      | 30/30 [00:08<00:00,  3.63it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.69it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:08<00:00,  3.74it/s]
100%|      | 30/30 [00:08<00:00,  3.64it/s]
100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:08<00:00,  3.72it/s]
100%|      | 30/30 [00:08<00:00,  3.71it/s]
100%|      | 30/30 [00:08<00:00,  3.68it/s]
100%|      | 30/30 [00:08<00:00,  3.69it/s]
100%|      | 30/30 [00:08<00:00,  3.68it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:08<00:00,  3.69it/s]
100%|      | 30/30 [00:08<00:00,  3.65it/s]
100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.75it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:08<00:00,  3.73it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:08<00:00,  3.75it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.76it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
```

```
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.77it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.84it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:08<00:00,  3.56it/s]
100%|      | 30/30 [00:08<00:00,  3.63it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.83it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.81it/s]
100%|      | 30/30 [00:07<00:00,  3.82it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]
100%|      | 30/30 [00:07<00:00,  3.78it/s]
100%|      | 30/30 [00:07<00:00,  3.79it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.86it/s]
100%|      | 30/30 [00:07<00:00,  3.80it/s]
100%|      | 30/30 [00:07<00:00,  3.88it/s]
100%|      | 30/30 [00:07<00:00,  3.85it/s]

Epoch 1/5
 3/12 [======>…] - ETA: 0s - loss: 0.0351 - accuracy:
0.9961


12/12 [==============================] - 0s 36ms/step - loss: 0.0298 - accuracy:
0.9980
Epoch 2/5
12/12 [==============================] - 0s 34ms/step - loss: 0.0156 - accuracy:
0.9997
Epoch 3/5
12/12 [==============================] - 0s 35ms/step - loss: 0.0124 - accuracy:
0.9987
Epoch 4/5
12/12 [==============================] - 0s 34ms/step - loss: 0.0088 - accuracy:
```

```
0.9990
Epoch 5/5
12/12 [==============================] - 0s 36ms/step - loss: 0.0080 - accuracy:
0.9987
4/4 [==============================] - 0s 13ms/step - loss: 0.0665 - accuracy:
0.9744

100%|      | 30/30 [00:00<00:00, 105.08it/s]
100%|      | 30/30 [00:00<00:00, 105.95it/s]
100%|      | 30/30 [00:00<00:00, 99.47it/s]
100%|      | 30/30 [00:00<00:00, 97.27it/s]
100%|      | 30/30 [00:00<00:00, 105.91it/s]
100%|      | 30/30 [00:00<00:00, 105.78it/s]
100%|      | 30/30 [00:00<00:00, 94.41it/s]
100%|      | 30/30 [00:00<00:00, 86.63it/s]
100%|      | 30/30 [00:00<00:00, 92.91it/s]
100%|      | 30/30 [00:00<00:00, 99.97it/s]
100%|      | 30/30 [00:00<00:00, 103.25it/s]
100%|      | 30/30 [00:00<00:00, 92.73it/s]
100%|      | 30/30 [00:00<00:00, 100.30it/s]
100%|      | 30/30 [00:00<00:00, 96.03it/s]
100%|      | 30/30 [00:00<00:00, 103.74it/s]
100%|      | 30/30 [00:00<00:00, 104.46it/s]
100%|      | 30/30 [00:00<00:00, 106.31it/s]
100%|      | 30/30 [00:00<00:00, 109.33it/s]
100%|      | 30/30 [00:00<00:00, 99.89it/s]
100%|      | 30/30 [00:00<00:00, 100.44it/s]
100%|      | 30/30 [00:00<00:00, 98.51it/s]
100%|      | 30/30 [00:00<00:00, 97.38it/s]
100%|      | 30/30 [00:00<00:00, 96.03it/s]
100%|      | 30/30 [00:00<00:00, 97.00it/s]
100%|      | 30/30 [00:00<00:00, 100.83it/s]
100%|      | 30/30 [00:00<00:00, 98.29it/s]
100%|      | 30/30 [00:00<00:00, 103.90it/s]
100%|      | 30/30 [00:00<00:00, 106.35it/s]
100%|      | 30/30 [00:00<00:00, 110.45it/s]
100%|      | 30/30 [00:00<00:00, 100.26it/s]
100%|      | 30/30 [00:00<00:00, 102.67it/s]
100%|      | 30/30 [00:00<00:00, 100.61it/s]
100%|      | 30/30 [00:00<00:00, 106.67it/s]
100%|      | 30/30 [00:00<00:00, 104.90it/s]
100%|      | 30/30 [00:00<00:00, 102.57it/s]
100%|      | 30/30 [00:00<00:00, 108.06it/s]
100%|      | 30/30 [00:00<00:00, 96.64it/s]
100%|      | 30/30 [00:00<00:00, 102.53it/s]
100%|      | 30/30 [00:00<00:00, 102.21it/s]
100%|      | 30/30 [00:00<00:00, 94.07it/s]
100%|      | 30/30 [00:00<00:00, 98.02it/s]
```

```
100%|      | 30/30 [00:00<00:00, 103.72it/s]
100%|      | 30/30 [00:00<00:00, 86.82it/s]
100%|      | 30/30 [00:00<00:00, 95.39it/s]
100%|      | 30/30 [00:00<00:00, 103.59it/s]
100%|      | 30/30 [00:00<00:00, 100.61it/s]
100%|      | 30/30 [00:00<00:00, 101.59it/s]
100%|      | 30/30 [00:00<00:00, 99.55it/s]
100%|      | 30/30 [00:00<00:00, 108.39it/s]
100%|      | 30/30 [00:00<00:00, 94.40it/s]
100%|      | 30/30 [00:00<00:00, 97.18it/s]
100%|      | 30/30 [00:00<00:00, 107.53it/s]
100%|      | 30/30 [00:00<00:00, 103.38it/s]
100%|      | 30/30 [00:00<00:00, 92.79it/s]
100%|      | 30/30 [00:00<00:00, 87.56it/s]
100%|      | 30/30 [00:00<00:00, 102.06it/s]
100%|      | 30/30 [00:00<00:00, 103.73it/s]
100%|      | 30/30 [00:00<00:00, 104.98it/s]
100%|      | 30/30 [00:00<00:00, 102.57it/s]
100%|      | 30/30 [00:00<00:00, 95.61it/s]
100%|      | 30/30 [00:00<00:00, 98.66it/s]
100%|      | 30/30 [00:00<00:00, 93.53it/s]
100%|      | 30/30 [00:00<00:00, 96.23it/s]
100%|      | 30/30 [00:00<00:00, 94.58it/s]
100%|      | 30/30 [00:00<00:00, 105.54it/s]
100%|      | 30/30 [00:00<00:00, 93.94it/s]
100%|      | 30/30 [00:00<00:00, 103.97it/s]
100%|      | 30/30 [00:00<00:00, 91.19it/s]
100%|      | 30/30 [00:00<00:00, 101.87it/s]
100%|      | 30/30 [00:00<00:00, 106.41it/s]
100%|      | 30/30 [00:00<00:00, 109.09it/s]
100%|      | 30/30 [00:00<00:00, 106.50it/s]
100%|      | 30/30 [00:00<00:00, 97.65it/s]
100%|      | 30/30 [00:00<00:00, 104.06it/s]
100%|      | 30/30 [00:00<00:00, 91.90it/s]
100%|      | 30/30 [00:00<00:00, 86.01it/s]
100%|      | 30/30 [00:00<00:00, 105.08it/s]
100%|      | 30/30 [00:00<00:00, 110.59it/s]
100%|      | 30/30 [00:00<00:00, 99.45it/s]
100%|      | 30/30 [00:00<00:00, 100.87it/s]
100%|      | 30/30 [00:00<00:00, 103.33it/s]
100%|      | 30/30 [00:00<00:00, 97.90it/s]
100%|      | 30/30 [00:00<00:00, 98.82it/s]
100%|      | 30/30 [00:00<00:00, 95.24it/s]
100%|      | 30/30 [00:00<00:00, 102.44it/s]
100%|      | 30/30 [00:00<00:00, 104.09it/s]
100%|      | 30/30 [00:00<00:00, 99.73it/s]
100%|      | 30/30 [00:00<00:00, 88.68it/s]
100%|      | 30/30 [00:00<00:00, 104.23it/s]
```

```
100%|      | 30/30 [00:00<00:00, 101.97it/s]
100%|      | 30/30 [00:00<00:00, 99.33it/s]
100%|      | 30/30 [00:00<00:00, 99.11it/s]
100%|      | 30/30 [00:00<00:00, 88.98it/s]
100%|      | 30/30 [00:00<00:00, 104.96it/s]
100%|      | 30/30 [00:00<00:00, 100.85it/s]
100%|      | 30/30 [00:00<00:00, 98.77it/s]
100%|      | 30/30 [00:00<00:00, 109.50it/s]
100%|      | 30/30 [00:00<00:00, 107.98it/s]
100%|      | 30/30 [00:00<00:00, 99.08it/s]
```

```
Epoch 1/5
12/12 [==============================] - 0s 33ms/step - loss: 0.0950 - accuracy:
0.9637
Epoch 2/5
12/12 [==============================] - 0s 34ms/step - loss: 0.0724 - accuracy:
0.9790
Epoch 3/5
12/12 [==============================] - 0s 34ms/step - loss: 0.0604 - accuracy:
0.9823
Epoch 4/5
12/12 [==============================] - 0s 33ms/step - loss: 0.0457 - accuracy:
0.9853
Epoch 5/5
12/12 [==============================] - 0s 35ms/step - loss: 0.0345 - accuracy:
0.9913
4/4 [==============================] - 0s 13ms/step - loss: 0.0601 - accuracy:
0.9767
```

```
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.48it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
100%|      | 30/30 [00:03<00:00,  8.20it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.33it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.42it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.43it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  7.88it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.06it/s]
100%|      | 30/30 [00:03<00:00,  8.44it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.03it/s]
100%|      | 30/30 [00:03<00:00,  8.16it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.48it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.00it/s]
100%|      | 30/30 [00:03<00:00,  8.41it/s]
100%|      | 30/30 [00:03<00:00,  8.40it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.12it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.38it/s]
100%|      | 30/30 [00:03<00:00,  8.02it/s]
100%|      | 30/30 [00:03<00:00,  8.36it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
```

```
100%|      | 30/30 [00:03<00:00,  8.34it/s]
100%|      | 30/30 [00:03<00:00,  8.25it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.29it/s]
100%|      | 30/30 [00:03<00:00,  8.15it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.11it/s]
100%|      | 30/30 [00:03<00:00,  8.21it/s]
100%|      | 30/30 [00:03<00:00,  8.26it/s]
100%|      | 30/30 [00:03<00:00,  8.18it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.24it/s]
100%|      | 30/30 [00:03<00:00,  8.22it/s]
100%|      | 30/30 [00:03<00:00,  8.32it/s]
100%|      | 30/30 [00:03<00:00,  8.23it/s]
100%|      | 30/30 [00:03<00:00,  8.01it/s]
100%|      | 30/30 [00:03<00:00,  8.17it/s]
100%|      | 30/30 [00:03<00:00,  8.35it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
100%|      | 30/30 [00:03<00:00,  8.19it/s]
100%|      | 30/30 [00:03<00:00,  8.09it/s]
100%|      | 30/30 [00:03<00:00,  8.39it/s]
100%|      | 30/30 [00:03<00:00,  8.13it/s]
100%|      | 30/30 [00:03<00:00,  8.10it/s]
100%|      | 30/30 [00:03<00:00,  8.14it/s]
100%|      | 30/30 [00:03<00:00,  8.16it/s]
100%|      | 30/30 [00:03<00:00,  8.31it/s]
100%|      | 30/30 [00:03<00:00,  8.27it/s]
100%|      | 30/30 [00:03<00:00,  8.28it/s]
Epoch 1/5
12/12 [==============================] - 0s 35ms/step - loss: 0.0321 - accuracy:
0.9920
Epoch 2/5
12/12 [==============================] - 0s 34ms/step - loss: 0.0326 - accuracy:
0.9900
Epoch 3/5
12/12 [==============================] - 0s 34ms/step - loss: 0.0316 - accuracy:
0.9923
Epoch 4/5
12/12 [==============================] - 0s 35ms/step - loss: 0.0294 - accuracy:
0.9910
Epoch 5/5
12/12 [==============================] - 0s 34ms/step - loss: 0.0209 - accuracy:
0.9943
4/4 [==============================] - 0s 13ms/step - loss: 0.0746 - accuracy:
```

```
0.9711
Accuracy - None::  0.3633333444595337
Accuracy - jitter::  0.8933333158493042
Accuracy - scaling::  0.898888885974884
Accuracy - rotation::  0.8399999737739563
Accuracy - permutation::  0.8811110854148865
Accuracy - magnitude_warp::  0.8999999761581421
Accuracy - time_warp::  0.9055555462837219
Accuracy - window_slice::  0.9466666579246521
Accuracy - window_warp::  0.949999988079071
Accuracy - spawner::  0.9700000286102295
Accuracy - wdba::  0.9744444489479065
Accuracy - random_guided_warp::  0.9766666889190674
Accuracy - discriminative_guided_warp::  0.9711111187934875
```