14694 lines (14694 loc) · 1.51 MB

Traffic Vehicle Real Time Detection - ML Notebook 2 of 2

Dataset: https://datasetninja.com/vehicle-dataset-for-yolo

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Table of Contents

Overview

In the last notebook, we explored an EDA on all of the images in the dataset to understand the qualities of the image data. I had to organize the images by class via reading each JSON annotation file associated with the images, creating new directories for each class, and moving each file to their respective folder. From there, I was able to perform an organized EDA on the images. I explored the image aspect ratios, the width and height distributions of the dataset, the RGB channel intensity, and class distribution count of all images.

This notebook I will focus on a machine learning approach and neural network approach for my image data, where I will train the models to identify images based on their class. Once that is completed, I will make use of a YOLO model and work to deploy the model online by feeding the model an image, and having it identify the objects in the image in real time, with the objects being type of vehicle.

In [1]:

```
#Importing in libraries to work with the image data.
import os
import shutil
import json
import cv2
import numpy as np
import pandas as pd
import seaborn as sns
from PIL import Image as Image
import matplotlib.pyplot as plt
from matplotlib.lines import Line2D

#Classic ML
from skimage.feature import hog
from skimage import color, exposure
from sklearn.model_selection import train_test_split, StratifiedKFold, Repeat
from sklearn.metrics import classification_report, confusion_matrix, accuracy
from sklearn.model_selection import RandomizedSearchCV

# Machine Learning Algorithms
from sklearn.impute import KNNImputer
from sklearn.neighbors import KNeighborsClassifier
from sklearn.svm import SVC, SVR
from sklearn.tree import DecisionTreeClassifier
from sklearn.naive_bayes import GaussianNB, MultinomialNB
from sklearn.linear_model import LogisticRegression, SGDClassifier
from sklearn.ensemble import RandomForestClassifier, AdaBoostClassifier, Grad
from sklearn.metrics import roc_curve, RocCurveDisplay, roc_auc_score

# TensorFlow and deep learning libraries
import tensorflow as tf
from keras.utils import to_categorical
from keras.callbacks import EarlyStopping, ModelCheckpoint

# Ignore Warnings
import warnings
warnings.filterwarnings("ignore")
```

Section 1: Machine Learning Approach

In this section I will train basic machine learning models on my image data to see if it can predict my classes. I believe that it will not do such a good job on predicting images that have numerous classes in it, such as a car, truck, and motorcycle all in one image. These classifiers will have an incredibly difficult time distinguishing the differences of the complex heuristics of these images. Let's dive in and take a look.

In [8]:
```
#Set class specific output paths

from pathlib import Path

# Note: Please update this static path to where ever the directory is on your
static_path = Path(r"C:\Users\chris\Desktop\capstone project\Traffic_Vehicle_

annotations_path = static_path / "ann"
images_path = static_path / "img"
bus_path = static_path / "buses"
cars_path = static_path / "cars"
motorcycles_path = static_path / "motorcycles"
threewheels_path = static_path / "threewheels"
trucks_path = static_path / "trucks"
vans_path = static_path / "vans"
multiclass_path = static_path / "multiclass"

class_directories = {
    'bus': bus_path,
    'car': cars_path,
    'motorcycles': motorcycles_path,
    'threewheel': threewheels_path,
    'truck': trucks_path,
    'van': vans_path,
    'multiclass': multiclass_path
}
```

In [3]:
```
#Here I am extracting out the images from my combined folder, and adding them
#By default, cv2 stores image in BGR format, in which to display some images,

image = []
class_name = []

#go through the folders and classes in dictionary
for object_name, folder_path in class_directories.items():

    #list of images in newly created folders
    pictures = os.listdir(folder_path)

    for img in pictures:
        img_path = os.path.join(folder_path, img)
        current = cv2.imread(img_path)
        #Convert to RGB for plotting for matplotlib
        current_rgb = cv2.cvtColor(current, cv2.COLOR_BGR2RGB)

        image.append(current_rgb)
        class_name.append(object_name)
```

Now that we have some of the images sorted, let's have a look at what we are working with.

In [4]:
```
#Inspect a few images in the image list
```

```
# Display one image from each folder
for i in range(3):
    plt.figure(figsize=(5, 5))
    plt.imshow(image[i])
    plt.title(f"Class: {class_name[i]}")
    plt.axis('off')
    plt.show()
```

In [14]:

```
#Going to prepare image data to work with. I will first handle the training a

image_data = []
labels = []

class_label_mapping = {
    'bus': 0,
    'car': 1,
    'motorcycles': 2,
    'threewheel': 3,
    'truck': 4,
    'van': 5,
    'multiclass': 6
}

#go through the folders and classes in dictionary
for object_name, folder_path in class_directories.items():

        for image in os.listdir(folder_path):
            image_path = os.path.join(folder_path, image)

            #read the image in color.
            img = cv2.imread(image_path, cv2.IMREAD_COLOR)

            #this will only proceed if the image exists
            if img is not None:
                #resize image to fixed size so its uniform ( as most images h
                img_resized = cv2.resize(img, (128,128))

                #make image interpretable for machine models by flattening it
                img_flattened = img_resized.flatten()

                #add the flattened image and the label to the lists above tha
                image_data.append(img_flattened)
                labels.append(class_label_mapping[object_name])
            else:
                print(f"The image could not be read {image_path}")

#convert the lists into numpy arrays for efficiency
image_data = np.array(image_data)
labels = np.array(labels)
```

In [17]:

```
#Convert image data to a DataFrame
df = pd.DataFrame(image_data)

#Scale data so it is more managable for machine models.
df = df / 255
```

```
# Add the labels as the target column
df['label'] = labels

df
```

Out[17]:

	0	1	2	3	4	5	6	7
0	0.996078	0.768627	0.545098	0.996078	0.772549	0.549020	0.996078	0.776471
1	0.901961	0.866667	0.878431	0.905882	0.870588	0.882353	0.905882	0.870588
2	1.000000	0.992157	1.000000	0.972549	0.992157	0.992157	0.549020	0.541176
3	0.376471	0.501961	0.419608	0.415686	0.501961	0.447059	0.505882	0.549020
4	0.211765	0.172549	0.400000	0.396078	0.352941	0.529412	0.333333	0.286275
...	...	...	...	...	...	...	...	...
2095	0.098039	0.117647	0.129412	0.117647	0.094118	0.098039	0.066667	0.062745
2096	0.164706	0.345098	0.341176	0.713725	0.701961	0.662745	0.917647	0.874510
2097	0.023529	0.298039	0.235294	0.211765	0.443137	0.400000	0.290196	0.462745
2098	0.929412	0.894118	0.854902	0.929412	0.894118	0.854902	0.929412	0.894118
2099	0.203922	0.176471	0.188235	0.286275	0.333333	0.309804	0.094118	0.231373

2100 rows × 49153 columns

In [18]:

```
#Going to create a function for "Shotgun approach" for machine learning model

def classification_model_test(model, X_train, y_train, X_test, y_test):
    # Fit the model with the training data
    model.fit(X_train, y_train)

    # Make predictions on the test data
    y_pred = model.predict(X_test)

    # Calculate and return the accuracy score
    accuracy = accuracy_score(y_true=y_test, y_pred=y_pred)

    # Generate heatmap of confusion matrix
    sns.heatmap(confusion_matrix(y_true=y_test, y_pred=y_pred),
            annot=True,
            cmap="coolwarm",
            square=True)

    # Print classification report
    print(classification_report(y_true=y_test, y_pred=y_pred))

    return f"Accuracy Score: {accuracy:.2f}"
```

In [19]:

```
X = df.drop(columns=['label'])
y = df['label']

# Split the data into training and test sets
X_train, X_test, y_train, y_test = train_test_split(X, y, train_size=0.8, tes
```

Now that the image data has been sorted and we have training and test splits, lets employ our machine learning shotgun approach and see how our basic classifiers perform our image data.

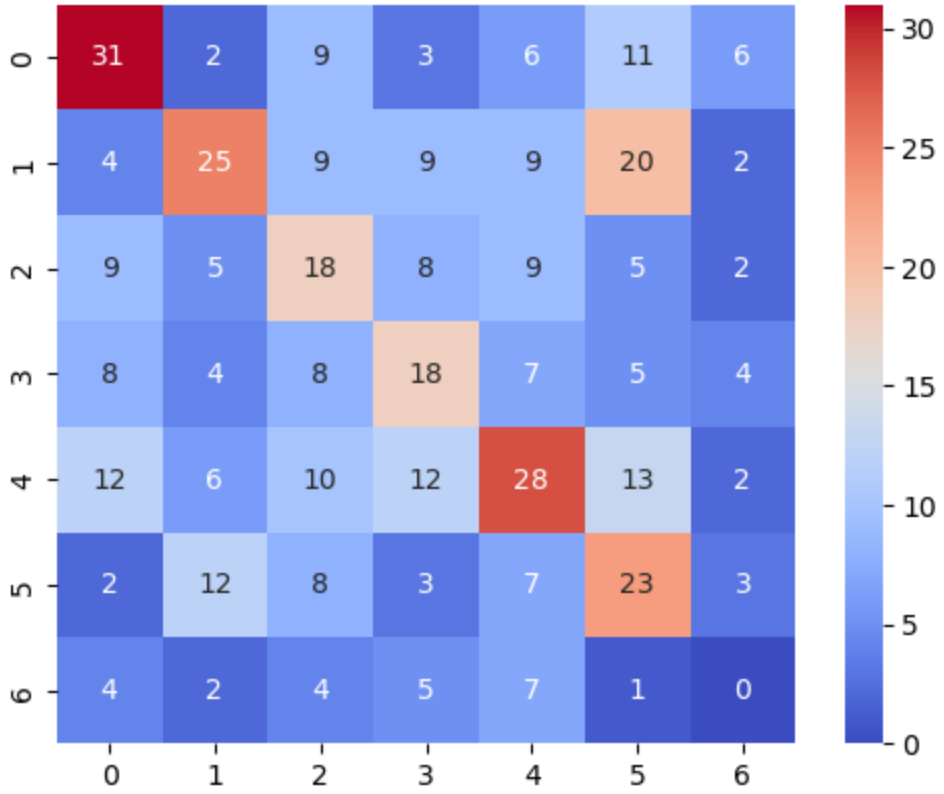
In [20]:
```
log_reg = LogisticRegression()
classification_model_test(log_reg, X_train, y_train, X_test, y_test)
```

```
              precision    recall  f1-score   support

           0       0.44      0.46      0.45        68
           1       0.45      0.32      0.37        78
           2       0.27      0.32      0.30        56
           3       0.31      0.33      0.32        54
           4       0.38      0.34      0.36        83
           5       0.29      0.40      0.34        58
           6       0.00      0.00      0.00        23

    accuracy                           0.34       420
   macro avg       0.31      0.31      0.31       420
weighted avg       0.35      0.34      0.34       420
```

Out[20]: 'Accuracy Score: 0.34'



In [21]:
```
sgd_model = SGDClassifier()
```

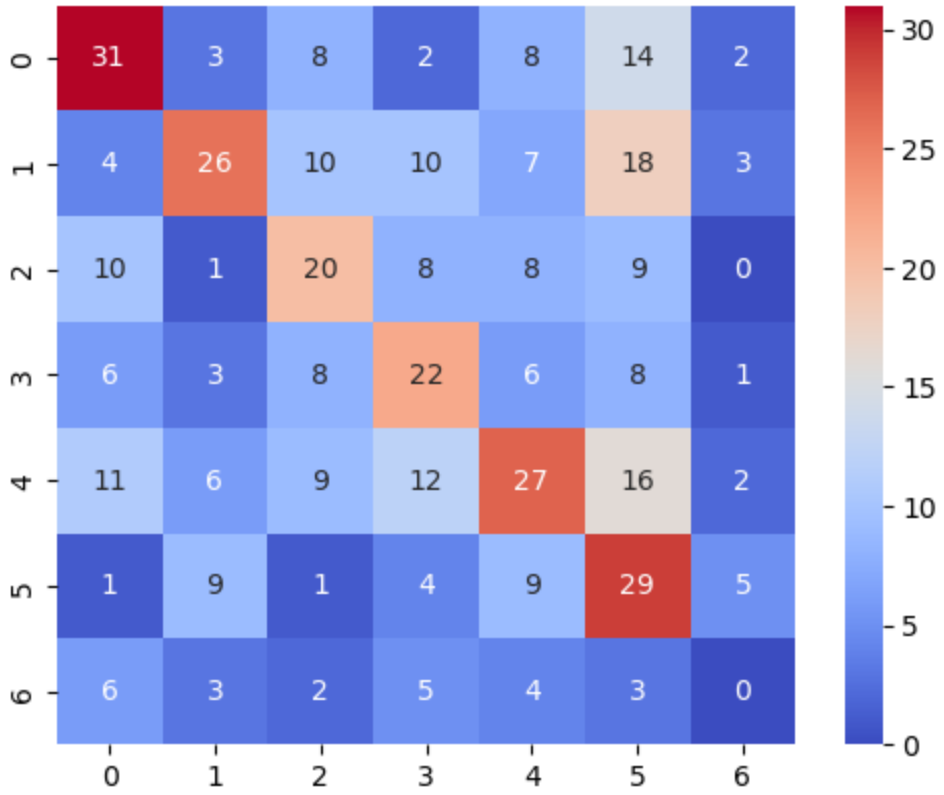
```
classification_model_test(sgd_model, X_train, y_train, X_test, y_test)
```

```
              precision    recall  f1-score   support

           0       0.45      0.46      0.45        68
           1       0.51      0.33      0.40        78
           2       0.34      0.36      0.35        56
           3       0.35      0.41      0.38        54
           4       0.39      0.33      0.36        83
           5       0.30      0.50      0.37        58
           6       0.00      0.00      0.00        23

    accuracy                           0.37       420
   macro avg       0.33      0.34      0.33       420
weighted avg       0.38      0.37      0.37       420
```

Out[21]: 'Accuracy Score: 0.37'



In [22]:

```
svc_model = SVC()
classification_model_test(svc_model, X_train, y_train, X_test, y_test)
```

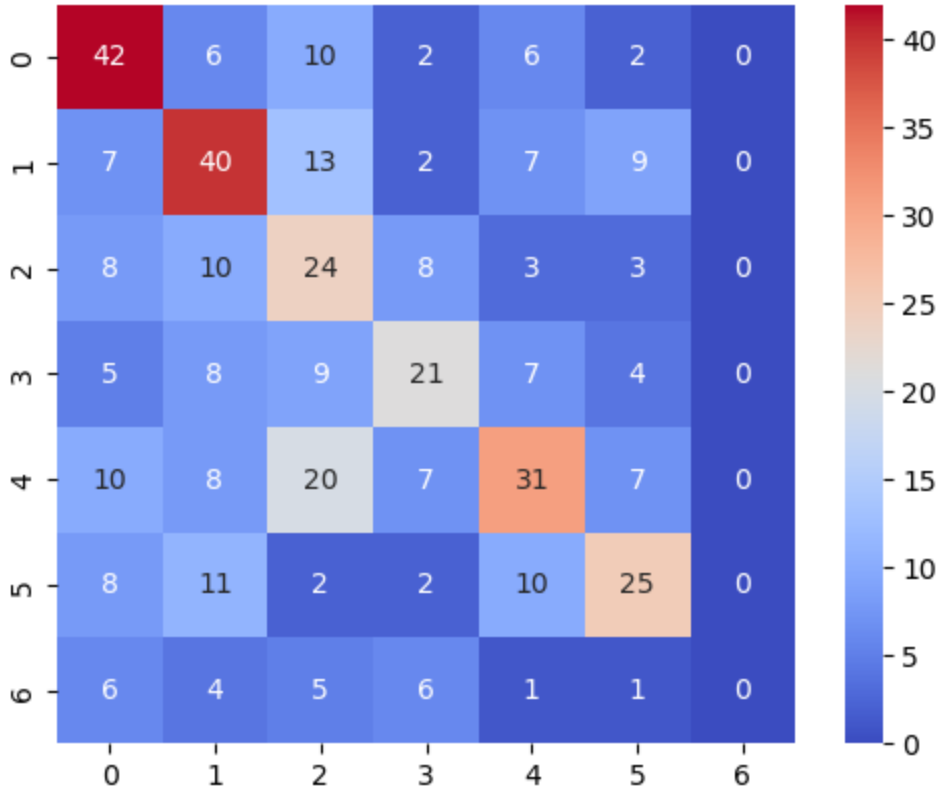
```
              precision    recall  f1-score   support

           0       0.49      0.62      0.55        68
           1       0.46      0.51      0.48        78
           2       0.29      0.43      0.35        56
           3       0.44      0.39      0.41        54
           4       0.48      0.37      0.42        83
           5       0.49      0.43      0.46        58
           6       0.00      0.00      0.00        23

    accuracy                           0.44       420
   macro avg       0.38      0.39      0.38       420
```

```
weighted avg       0.42      0.44      0.42       420
```

Out[22]: 'Accuracy Score: 0.44'



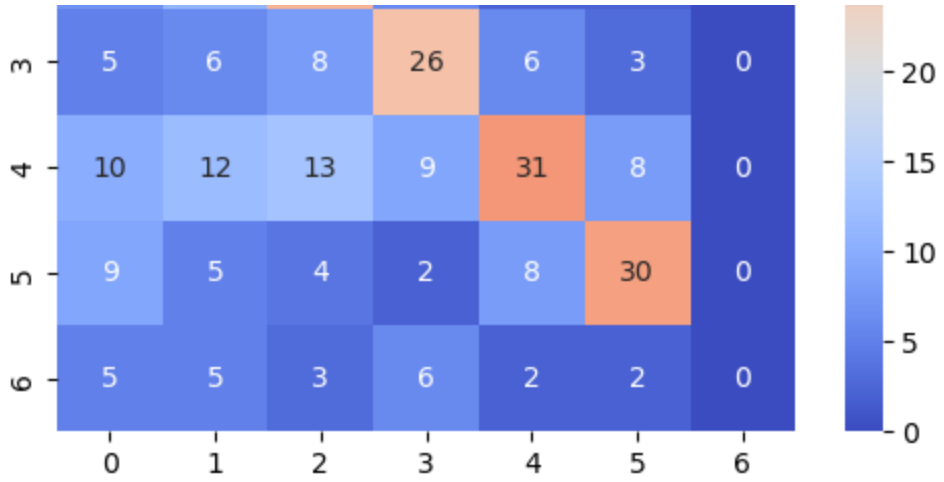
In [23]:
```
rfc_model = RandomForestClassifier()
classification_model_test(rfc_model, X_train, y_train, X_test, y_test)
```

```
              precision    recall  f1-score   support

           0       0.46      0.60      0.52        68
           1       0.40      0.44      0.42        78
           2       0.39      0.50      0.44        56
           3       0.47      0.48      0.48        54
           4       0.53      0.37      0.44        83
           5       0.49      0.52      0.50        58
           6       0.00      0.00      0.00        23

    accuracy                           0.45       420
   macro avg       0.39      0.42      0.40       420
weighted avg       0.43      0.45      0.44       420
```

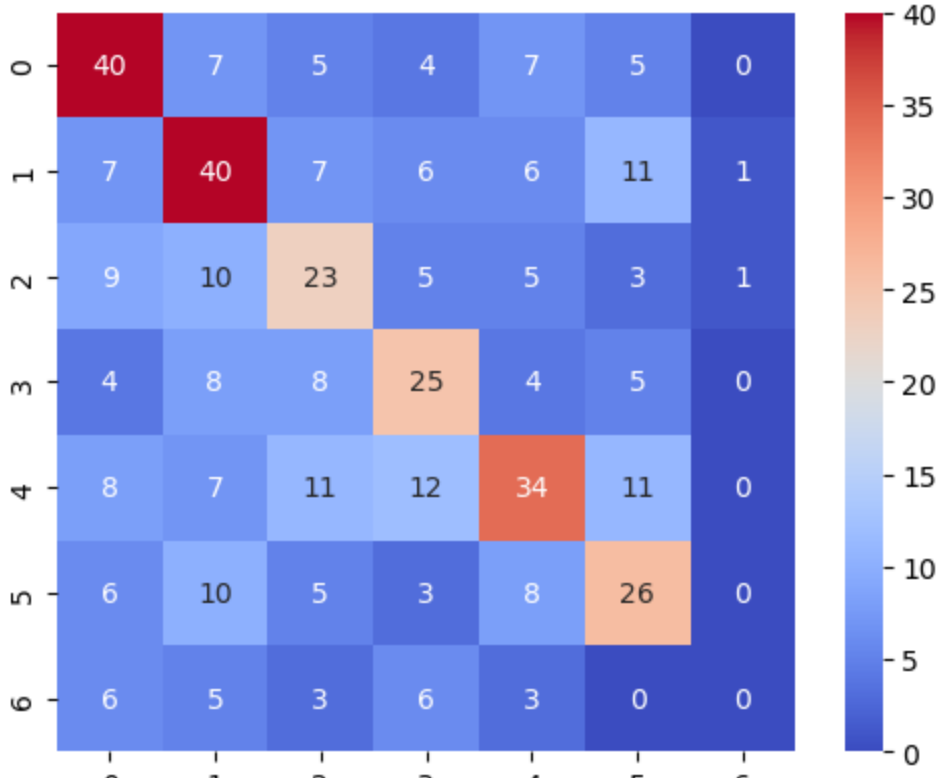
Out[23]: 'Accuracy Score: 0.45'



In [24]:
```
gbc_model = GradientBoostingClassifier()
classification_model_test(gbc_model, X_train, y_train, X_test, y_test)
```

	precision	recall	f1-score	support
0	0.50	0.59	0.54	68
1	0.46	0.51	0.48	78
2	0.37	0.41	0.39	56
3	0.41	0.46	0.43	54
4	0.51	0.41	0.45	83
5	0.43	0.45	0.44	58
6	0.00	0.00	0.00	23
accuracy			0.45	420
macro avg	0.38	0.40	0.39	420
weighted avg	0.43	0.45	0.44	420

Out[24]: 'Accuracy Score: 0.45'



0 1 2 3 4 5 6

After this shotgun approach on basic machine learning classifiers, it is clear that this data is very nuanced and basic ML classifiers are having trouble picking up on complex patterns within the image data. Therefore, I will employ a CNN model and train it to learn about the complex heuristics of the images.

Section 2: Deep Learning

In the last section, I employed a shotgun approach on my image data to see if the basic classifiers are good enough at identifying classes within images. As it turns out, they were not good at predicting, as to be expected. In this section, I will develop a custom CNN network to try and predict the classes.

In [5]:
```
#Instancing a Sequential model
Sequential = tf.keras.models.Sequential

#CNN Network Layers
Dense = tf.keras.layers.Dense
Dropout = tf.keras.layers.Dropout
Flatten = tf.keras.layers.Flatten
Conv2D = tf.keras.layers.Conv2D
MaxPool2D = tf.keras.layers.MaxPool2D

#Optimizer
Adam = tf.keras.optimizers.Adam

#Image Preprocessing
ImageDataGenerator =  tf.keras.preprocessing.image.ImageDataGenerator
```

In [6]:
```
#Going to prepare image data to work with. I will first handle the training a

cnn_image_data = []
cnn_labels = []
class_directories = {
    'bus': bus_path,
    'car': cars_path,
    'motorcycles': motorcycles_path,
    'threewheel': threewheels_path,
    'truck': trucks_path,
    'van': vans_path,
    'multiclass': multiclass_path
}

class_label_mapping = {
    'bus': 0,
    'car': 1,
    'motorcycles': 2,
    'threewheel': 3,
    'truck': 4,
    'van': 5,
    'multiclass': 6
}
```

```
#go through the folders and classes in dictionary
for object_name, folder_path in class_directories.items():

        for image in os.listdir(folder_path):
            image_path = os.path.join(folder_path, image)

            #read the image in color.
            img = cv2.imread(image_path, cv2.IMREAD_COLOR)

            #this will only proceed if the image exists
            if img is not None:
                #resize image to fixed size so its uniform ( as most images h
                img_resized = cv2.resize(img, (128,128))

                #add the flattened image and the label to the lists above tha
                cnn_image_data.append(img_resized)
                cnn_labels.append(class_label_mapping[object_name])
            else:
                print(f"The image could not be read {image_path}")

#convert the lists into numpy arrays for efficiency
cnn_image_data = np.array(cnn_image_data)
cnn_labels = np.array(cnn_labels)
```

In [7]:

```
#I am going to scale the image data to 0-1 range for the model.

cnn_image_data = cnn_image_data / 255.0

cnn_image_data
```

Out[7]:

```
array([[[[0.99607843, 0.76862745, 0.54509804],
         [0.99607843, 0.77254902, 0.54901961],
         [0.99607843, 0.77647059, 0.55294118],
         ...,
         [0.99215686, 0.78431373, 0.52941176],
         [0.99215686, 0.78431373, 0.52941176],
         [0.99607843, 0.77647059, 0.5254902 ]],

        [[0.99607843, 0.76862745, 0.5372549 ],
         [0.99607843, 0.76862745, 0.5372549 ],
         [0.99215686, 0.77254902, 0.54117647],
         ...,
         [1.        , 0.78823529, 0.54117647],
         [1.        , 0.78823529, 0.54117647],
         [1.        , 0.78039216, 0.5372549 ]],

        [[1.        , 0.76862745, 0.5372549 ],
         [0.99607843, 0.76862745, 0.5372549 ],
         [0.99607843, 0.76862745, 0.5372549 ],
         ...,
         [1.        , 0.78431373, 0.54509804],
         [1.        , 0.78431373, 0.54117647],
         [1.        , 0.78039216, 0.54117647]],

        ...,
```

```
       [[0.49803922, 0.56078431, 0.57254902],
        [0.50588235, 0.56470588, 0.57254902],
        [0.47843137, 0.5254902 , 0.5254902 ],
        ...,
        [0.4627451 , 0.52156863, 0.50588235],
        [0.49803922, 0.54509804, 0.53333333],
        [0.50588235, 0.54901961, 0.5372549 ]],

       [[0.50588235, 0.6       , 0.6       ],
        [0.48627451, 0.56862745, 0.57254902],
        [0.46666667, 0.54117647, 0.54509804],
        ...,
        [0.44705882, 0.49411765, 0.4745098 ],
        [0.49019608, 0.52941176, 0.50980392],
        [0.45098039, 0.49019608, 0.46666667]],

       [[0.48235294, 0.56078431, 0.56470588],
        [0.48627451, 0.54509804, 0.55294118],
        [0.47058824, 0.54901961, 0.55294118],
        ...,
        [0.49803922, 0.5372549 , 0.51764706],
        [0.45098039, 0.49019608, 0.46666667],
        [0.48235294, 0.50980392, 0.48627451]]],


      [[[0.90196078, 0.86666667, 0.87843137],
        [0.90588235, 0.87058824, 0.88235294],
        [0.90588235, 0.87058824, 0.88235294],
        ...,
        [0.91764706, 0.88235294, 0.89411765],
        [0.91372549, 0.87843137, 0.89019608],
        [0.90980392, 0.8745098 , 0.88627451]],

       [[0.89803922, 0.86666667, 0.8745098 ],
        [0.90588235, 0.87058824, 0.88235294],
        [0.90980392, 0.8745098 , 0.88627451],
        ...,
        [0.91764706, 0.88235294, 0.89411765],
        [0.91372549, 0.87843137, 0.89019608],
        [0.90980392, 0.8745098 , 0.88627451]],

       [[0.89803922, 0.8627451 , 0.8745098 ],
        [0.90588235, 0.87058824, 0.88235294],
        [0.90980392, 0.87058824, 0.88235294],
        ...,
        [0.91764706, 0.88235294, 0.89411765],
        [0.91372549, 0.87843137, 0.89019608],
        [0.90980392, 0.8745098 , 0.88627451]],

       ...,

       [[0.49411765, 0.50196078, 0.54117647],
        [0.4745098 , 0.48627451, 0.52156863],
        [0.48235294, 0.50588235, 0.52941176],
        ...,
        [0.54901961, 0.54509804, 0.58823529],
        [0.52941176, 0.52156863, 0.56862745],
        [0.55294118, 0.54509804, 0.58823529]],

       [[0.4627451 , 0.47843137, 0.50980392],
        [0.4745098 , 0.49803922, 0.52156863],
```

```
       [0.47843137, 0.50196078, 0.52156863],
       ...,
       [0.54117647, 0.54117647, 0.58431373],
       [0.54117647, 0.54117647, 0.58823529],
       [0.54117647, 0.54117647, 0.58823529]],

      [[0.49411765, 0.50980392, 0.5254902 ],
       [0.48235294, 0.50196078, 0.51372549],
       [0.4627451 , 0.48235294, 0.49411765],
       ...,
       [0.51372549, 0.52156863, 0.56078431],
       [0.50980392, 0.51764706, 0.55686275],
       [0.51764706, 0.5254902 , 0.56470588]]],


     [[[1.        , 0.99215686, 1.        ],
       [0.97254902, 0.99215686, 0.99215686],
       [0.54901961, 0.54117647, 0.51764706],
       ...,
       [0.88235294, 0.85882353, 0.80784314],
       [0.89411765, 0.8745098 , 0.82352941],
       [0.90980392, 0.87058824, 0.82745098]],

      [[1.        , 0.99215686, 0.99607843],
       [0.96862745, 0.98823529, 0.98431373],
       [0.55686275, 0.54509804, 0.52156863],
       ...,
       [0.83137255, 0.82352941, 0.80784314],
       [0.8       , 0.78431373, 0.76470588],
       [0.94117647, 0.88627451, 0.84705882]],

      [[0.99215686, 0.99607843, 0.99607843],
       [0.96470588, 0.99215686, 0.98823529],
       [0.54509804, 0.54509804, 0.51764706],
       ...,
       [0.60784314, 0.62352941, 0.62745098],
       [0.73333333, 0.77647059, 0.77647059],
       [0.81176471, 0.83921569, 0.83137255]],

      ...,

      [[0.26666667, 0.27843137, 0.25882353],
       [0.27843137, 0.28235294, 0.26666667],
       [0.28235294, 0.28235294, 0.26666667],
       ...,
       [0.42352941, 0.41960784, 0.43529412],
       [0.43921569, 0.44313725, 0.45490196],
       [0.43921569, 0.44313725, 0.45490196]],

      [[0.27058824, 0.27843137, 0.25490196],
       [0.2627451 , 0.25882353, 0.23921569],
       [0.2745098 , 0.27058824, 0.25098039],
       ...,
       [0.43137255, 0.43529412, 0.43137255],
       [0.42352941, 0.42745098, 0.42745098],
       [0.38039216, 0.38039216, 0.38039216]],

      [[0.26666667, 0.27058824, 0.25098039],
       [0.27058824, 0.27058824, 0.24313725],
       [0.2745098 , 0.26666667, 0.23529412],
```

```
  ...,
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```

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```

In [8]:

```
#Split the data into training and test sets
X_train_cnn, X_test_cnn, y_train_cnn, y_test_cnn = train_test_split(cnn_image

#Image Type Forcing
X_train_cnn = X_train_cnn.astype("float32"); X_test_cnn = X_test_cnn.astype("
```

In [9]:

```
#One-hot encode the labels
y_train_cnn = to_categorical(y_train_cnn, num_classes=7)
y_test_cnn = to_categorical(y_test_cnn, num_classes=7)
```

In [10]:

```
# Here I will define the network layers.
convolutional_layer_1 = Conv2D(50,
                               kernel_size=(3, 3),
                               strides=(1, 1),
                               padding="same",
                               activation="relu"
```

```
                                activation="relu",
                                input_shape=(128, 128, 3))
convolutional_layer_2 = Conv2D(75,
                                kernel_size=(3, 3),
                                strides=(1, 1),
                                padding="same",
                                activation="relu")
convolutional_layer_3 = Conv2D(125,
                                kernel_size=(3, 3),
                                strides=(1, 1),
                                padding="same",
                                activation="relu")

# Two corresponding pooling layers to reduce convolved dimensionality
pooling_layer_1 =         MaxPool2D(pool_size=(2, 2))
pooling_layer_2 =         MaxPool2D(pool_size=(2, 2))

# Four dropout layers: two for the convolutions and two for the ANN
dropout_layer_1 =         Dropout(0.25)
dropout_layer_2 =         Dropout(0.25)
dropout_layer_3 =         Dropout(0.4)
dropout_layer_4 =         Dropout(0.3)

# A flattening layer for ingestion into the ANN
flattening_layer_1 =      Flatten()

# Three dense layers to make up the significant ANN architecture
connective_layer_1 =      Dense(500, activation="relu")
connective_layer_2 =      Dense(250, activation="relu")
output_layer =            Dense(7, activation="softmax")
```

In [11]:

```
# Initialize sequential model schema
model = Sequential()

# Add first convolutional feature mapping process layers
model.add(convolutional_layer_1)

# Add second convolutional feature mapping process layers
model.add(convolutional_layer_2)
model.add(pooling_layer_1)
model.add(dropout_layer_1)

# Add third convolutional feature mapping process layers
model.add(convolutional_layer_3)
model.add(pooling_layer_2)
model.add(dropout_layer_2)

# Add image vectorization process layer
model.add(flattening_layer_1)

# Add connective ANN process layers
model.add(connective_layer_1)
model.add(dropout_layer_3)
model.add(connective_layer_2)
model.add(dropout_layer_4)
model.add(output_layer)

# Summarize model layering setup
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 128, 128, 50)      1400

 conv2d_1 (Conv2D)           (None, 128, 128, 75)      33825

 max_pooling2d (MaxPooling2D  (None, 64, 64, 75)       0
 )

 dropout (Dropout)           (None, 64, 64, 75)        0

 conv2d_2 (Conv2D)           (None, 64, 64, 125)       84500

 max_pooling2d_1 (MaxPooling  (None, 32, 32, 125)      0
 2D)

 dropout_1 (Dropout)         (None, 32, 32, 125)       0

 flatten (Flatten)           (None, 128000)            0

 dense (Dense)               (None, 500)               64000500

 dropout_2 (Dropout)         (None, 500)               0

 dense_1 (Dense)             (None, 250)               125250

 dropout_3 (Dropout)         (None, 250)               0

 dense_2 (Dense)             (None, 7)                 1757

=================================================================
Total params: 64,247,232
Trainable params: 64,247,232
Non-trainable params: 0
_________________________________________________________________
```

In [12]:

```
#Define Adam optimization
optimizer = Adam(learning_rate=0.001)
```

In [22]:

```
#Set compilation properties
model.compile(optimizer=optimizer,
              loss="categorical_crossentropy",
              metrics=["accuracy"])

# Set epochs and batch size
epochs, batch_size = 100, 64
```

In [23]:

```
#Create image augmentation engine as generator-like object
generator = ImageDataGenerator(
    featurewise_center=False,
    samplewise_center=False,
    featurewise_std_normalization=False,
    samplewise_std_normalization=False,
    zca_whitening=False,
    rotation_range=5
```

```
    rotation_range=5,
    zoom_range=0.1,
    width_shift_range=0.1,
    height_shift_range=0.1,
    horizontal_flip=False,
    vertical_flip=False,
)

#Fit training data to augmentation generator
generator.fit(X_train_cnn)
```

In [24]:

```
#created this only if necessary to use. Doesn't seem like I will need this.

#Define EarlyStopping callback
early_stopping = EarlyStopping(
    monitor='val_loss',
    patience=5,          #this is the number of epochs with no improvement af
    restore_best_weights=True  # Rstores the model weights from the best epoc
)

#Define ModelCheckpoint callback to save the best model
model_checkpoint = ModelCheckpoint(
    filepath='best_model_traffic_images.h5',
    monitor='val_loss',
    save_best_only=True,
    verbose=1
)
```

In [25]:

```
print("Independent training set size:\t\t{}".format(X_train_cnn.shape))
print("Independent validation set size:\t{}".format(X_test_cnn.shape))
print("Target training set size:\t\t{}".format(y_train_cnn.shape))
print("Target validation set size:\t\t{}".format(y_test_cnn.shape))
```

```
Independent training set size:          (1680, 128, 128, 3)
Independent validation set size:        (420, 128, 128, 3)
Target training set size:               (1680, 7)
Target validation set size:             (420, 7)
```

In [26]:

```
# Fit model using generator-augmented dataset and mini-batch ingestion
history = model.fit(
    generator.flow(X_train_cnn,
                   y_train_cnn,
                   batch_size=batch_size),
    epochs=epochs,
    validation_data=(X_test_cnn, y_test_cnn),
    batch_size=batch_size,
    #callbacks=[early_stopping, model_checkpoint] #This is only if the model
)
```

```
Epoch 1/100
27/27 [==============================] - 4s 134ms/step - loss: 0.5320 - accurac
y: 0.8238 - val_loss: 1.4288 - val_accuracy: 0.6286
Epoch 2/100
27/27 [==============================] - 4s 127ms/step - loss: 0.5751 - accurac
```

```
y: 0.8024 - val_loss: 1.0757 - val_accuracy: 0.6857
Epoch 3/100
27/27 [==============================] - 4s 133ms/step - loss: 0.5286 - accurac
y: 0.8095 - val_loss: 1.2314 - val_accuracy: 0.6595
Epoch 4/100
27/27 [==============================] - 4s 144ms/step - loss: 0.4729 - accurac
y: 0.8375 - val_loss: 1.2873 - val_accuracy: 0.6643
Epoch 5/100
27/27 [==============================] - 4s 139ms/step - loss: 0.5196 - accurac
y: 0.8143 - val_loss: 1.1224 - val_accuracy: 0.6643
Epoch 6/100
27/27 [==============================] - 4s 130ms/step - loss: 0.4984 - accurac
y: 0.8185 - val_loss: 1.1524 - val_accuracy: 0.6833
Epoch 7/100
27/27 [==============================] - 4s 128ms/step - loss: 0.4905 - accurac
y: 0.8286 - val_loss: 1.0965 - val_accuracy: 0.6976
Epoch 8/100
27/27 [==============================] - 4s 128ms/step - loss: 0.4675 - accurac
y: 0.8345 - val_loss: 1.2590 - val_accuracy: 0.6810
Epoch 9/100
27/27 [==============================] - 4s 130ms/step - loss: 0.4960 - accurac
y: 0.8339 - val_loss: 1.5057 - val_accuracy: 0.6167
Epoch 10/100
27/27 [==============================] - 4s 131ms/step - loss: 0.4854 - accurac
y: 0.8298 - val_loss: 1.1767 - val_accuracy: 0.6881
Epoch 11/100
27/27 [==============================] - 4s 126ms/step - loss: 0.4424 - accurac
y: 0.8440 - val_loss: 1.2634 - val_accuracy: 0.6714
Epoch 12/100
27/27 [==============================] - 4s 131ms/step - loss: 0.4294 - accurac
y: 0.8589 - val_loss: 1.4254 - val_accuracy: 0.6595
Epoch 13/100
27/27 [==============================] - 4s 129ms/step - loss: 0.4589 - accurac
y: 0.8399 - val_loss: 1.2394 - val_accuracy: 0.6952
Epoch 14/100
27/27 [==============================] - 3s 125ms/step - loss: 0.3983 - accurac
y: 0.8661 - val_loss: 1.2895 - val_accuracy: 0.6810
Epoch 15/100
27/27 [==============================] - 3s 125ms/step - loss: 0.4132 - accurac
y: 0.8589 - val_loss: 1.2278 - val_accuracy: 0.6786
Epoch 16/100
27/27 [==============================] - 3s 126ms/step - loss: 0.3771 - accurac
y: 0.8661 - val_loss: 1.2453 - val_accuracy: 0.6690
Epoch 17/100
27/27 [==============================] - 4s 130ms/step - loss: 0.3510 - accurac
y: 0.8810 - val_loss: 1.1387 - val_accuracy: 0.6833
Epoch 18/100
27/27 [==============================] - 4s 134ms/step - loss: 0.3802 - accurac
y: 0.8726 - val_loss: 1.2758 - val_accuracy: 0.6738
Epoch 19/100
27/27 [==============================] - 3s 126ms/step - loss: 0.3466 - accurac
y: 0.8726 - val_loss: 1.3740 - val_accuracy: 0.6643
Epoch 20/100
27/27 [==============================] - 3s 126ms/step - loss: 0.3637 - accurac
y: 0.8720 - val_loss: 1.1906 - val_accuracy: 0.7024
Epoch 21/100
27/27 [==============================] - 3s 126ms/step - loss: 0.3577 - accurac
y: 0.8756 - val_loss: 1.3572 - val_accuracy: 0.6667
Epoch 22/100
27/27 [==============================] - 3s 123ms/step - loss: 0.3341 - accurac
y: 0.8851 - val_loss: 1.1882 - val_accuracy: 0.6929
```

```
Epoch 23/100
27/27 [==============================] - 4s 128ms/step - loss: 0.3175 - accurac
y: 0.8970 - val_loss: 1.4802 - val_accuracy: 0.6762
Epoch 24/100
27/27 [==============================] - 3s 125ms/step - loss: 0.3452 - accurac
y: 0.8798 - val_loss: 1.2152 - val_accuracy: 0.6976
Epoch 25/100
27/27 [==============================] - 4s 129ms/step - loss: 0.3341 - accurac
y: 0.8839 - val_loss: 1.5015 - val_accuracy: 0.6381
Epoch 26/100
27/27 [==============================] - 3s 127ms/step - loss: 0.3501 - accurac
y: 0.8815 - val_loss: 1.6403 - val_accuracy: 0.6524
Epoch 27/100
27/27 [==============================] - 3s 125ms/step - loss: 0.3035 - accurac
y: 0.8976 - val_loss: 1.4144 - val_accuracy: 0.6762
Epoch 28/100
27/27 [==============================] - 4s 126ms/step - loss: 0.3012 - accurac
y: 0.8917 - val_loss: 1.5889 - val_accuracy: 0.6762
Epoch 29/100
27/27 [==============================] - 4s 130ms/step - loss: 0.2961 - accurac
y: 0.8952 - val_loss: 1.4034 - val_accuracy: 0.6929
Epoch 30/100
27/27 [==============================] - 3s 126ms/step - loss: 0.2877 - accurac
y: 0.8893 - val_loss: 1.2769 - val_accuracy: 0.6952
Epoch 31/100
27/27 [==============================] - 3s 124ms/step - loss: 0.2865 - accurac
y: 0.9030 - val_loss: 1.3658 - val_accuracy: 0.6595
Epoch 32/100
27/27 [==============================] - 3s 125ms/step - loss: 0.2556 - accurac
y: 0.9125 - val_loss: 1.3850 - val_accuracy: 0.6524
Epoch 33/100
27/27 [==============================] - 3s 126ms/step - loss: 0.2514 - accurac
y: 0.9137 - val_loss: 1.4727 - val_accuracy: 0.6905
Epoch 34/100
27/27 [==============================] - 4s 129ms/step - loss: 0.2720 - accurac
y: 0.9036 - val_loss: 1.4044 - val_accuracy: 0.6786
Epoch 35/100
27/27 [==============================] - 4s 127ms/step - loss: 0.2306 - accurac
y: 0.9262 - val_loss: 1.2734 - val_accuracy: 0.6976
Epoch 36/100
27/27 [==============================] - 4s 129ms/step - loss: 0.2463 - accurac
y: 0.9149 - val_loss: 1.8942 - val_accuracy: 0.6452
Epoch 37/100
27/27 [==============================] - 4s 131ms/step - loss: 0.2566 - accurac
y: 0.9143 - val_loss: 1.2931 - val_accuracy: 0.6929
Epoch 38/100
27/27 [==============================] - 3s 125ms/step - loss: 0.2669 - accurac
y: 0.9054 - val_loss: 1.5178 - val_accuracy: 0.6690
Epoch 39/100
27/27 [==============================] - 3s 124ms/step - loss: 0.2492 - accurac
y: 0.9149 - val_loss: 1.4164 - val_accuracy: 0.6738
Epoch 40/100
27/27 [==============================] - 3s 124ms/step - loss: 0.2779 - accurac
y: 0.9065 - val_loss: 1.5403 - val_accuracy: 0.6762
Epoch 41/100
27/27 [==============================] - 3s 124ms/step - loss: 0.2656 - accurac
y: 0.9137 - val_loss: 1.4174 - val_accuracy: 0.6714
Epoch 42/100
27/27 [==============================] - 3s 125ms/step - loss: 0.2349 - accurac
y: 0.9226 - val_loss: 1.4476 - val_accuracy: 0.6976
```

```
Epoch 43/100
27/27 [==============================] - 3s 124ms/step - loss: 0.2370 - accurac
y: 0.9167 - val_loss: 1.5459 - val_accuracy: 0.6690
Epoch 44/100
27/27 [==============================] - 3s 123ms/step - loss: 0.2311 - accurac
y: 0.9214 - val_loss: 1.3579 - val_accuracy: 0.6619
Epoch 45/100
27/27 [==============================] - 3s 125ms/step - loss: 0.2007 - accurac
y: 0.9321 - val_loss: 1.4645 - val_accuracy: 0.7071
Epoch 46/100
27/27 [==============================] - 3s 125ms/step - loss: 0.2163 - accurac
y: 0.9274 - val_loss: 2.2676 - val_accuracy: 0.6238
Epoch 47/100
27/27 [==============================] - 4s 127ms/step - loss: 0.2785 - accurac
y: 0.9030 - val_loss: 1.5866 - val_accuracy: 0.6857
Epoch 48/100
27/27 [==============================] - 3s 126ms/step - loss: 0.2553 - accurac
y: 0.9190 - val_loss: 1.5557 - val_accuracy: 0.6833
Epoch 49/100
27/27 [==============================] - 4s 128ms/step - loss: 0.2176 - accurac
y: 0.9268 - val_loss: 1.3654 - val_accuracy: 0.6929
Epoch 50/100
27/27 [==============================] - 4s 128ms/step - loss: 0.2275 - accurac
y: 0.9220 - val_loss: 1.2556 - val_accuracy: 0.7071
Epoch 51/100
27/27 [==============================] - 3s 125ms/step - loss: 0.1938 - accurac
y: 0.9333 - val_loss: 1.4793 - val_accuracy: 0.6929
Epoch 52/100
27/27 [==============================] - 4s 129ms/step - loss: 0.1759 - accurac
y: 0.9381 - val_loss: 1.3347 - val_accuracy: 0.7095
Epoch 53/100
27/27 [==============================] - 3s 126ms/step - loss: 0.2002 - accurac
y: 0.9274 - val_loss: 1.3922 - val_accuracy: 0.7048
Epoch 54/100
27/27 [==============================] - 4s 128ms/step - loss: 0.2089 - accurac
y: 0.9238 - val_loss: 1.5840 - val_accuracy: 0.6619
Epoch 55/100
27/27 [==============================] - 4s 132ms/step - loss: 0.1724 - accurac
y: 0.9369 - val_loss: 1.6120 - val_accuracy: 0.6690
Epoch 56/100
27/27 [==============================] - 4s 127ms/step - loss: 0.1962 - accurac
y: 0.9339 - val_loss: 1.5787 - val_accuracy: 0.6738
Epoch 57/100
27/27 [==============================] - 3s 125ms/step - loss: 0.2014 - accurac
y: 0.9411 - val_loss: 1.4013 - val_accuracy: 0.6905
Epoch 58/100
27/27 [==============================] - 4s 132ms/step - loss: 0.2592 - accurac
y: 0.9155 - val_loss: 1.2772 - val_accuracy: 0.6857
Epoch 59/100
27/27 [==============================] - 4s 131ms/step - loss: 0.1804 - accurac
y: 0.9423 - val_loss: 1.4615 - val_accuracy: 0.6881
Epoch 60/100
27/27 [==============================] - 3s 124ms/step - loss: 0.1892 - accurac
y: 0.9351 - val_loss: 1.5751 - val_accuracy: 0.6929
Epoch 61/100
27/27 [==============================] - 4s 130ms/step - loss: 0.1642 - accurac
y: 0.9470 - val_loss: 1.4583 - val_accuracy: 0.7000
Epoch 62/100
27/27 [==============================] - 4s 127ms/step - loss: 0.1697 - accurac
y: 0.9452 - val_loss: 1.9202 - val_accuracy: 0.6500
Epoch 63/100
```

```
Epoch 63/100
27/27 [==============================] - 3s 125ms/step - loss: 0.2421 - accurac
y: 0.9196 - val_loss: 2.0222 - val_accuracy: 0.6095
Epoch 64/100
27/27 [==============================] - 3s 123ms/step - loss: 0.1670 - accurac
y: 0.9429 - val_loss: 1.5548 - val_accuracy: 0.6690
Epoch 65/100
27/27 [==============================] - 3s 122ms/step - loss: 0.1895 - accurac
y: 0.9387 - val_loss: 1.5736 - val_accuracy: 0.6857
Epoch 66/100
27/27 [==============================] - 4s 135ms/step - loss: 0.1873 - accurac
y: 0.9429 - val_loss: 1.4478 - val_accuracy: 0.7000
Epoch 67/100
27/27 [==============================] - 3s 122ms/step - loss: 0.1967 - accurac
y: 0.9369 - val_loss: 1.4221 - val_accuracy: 0.6976
Epoch 68/100
27/27 [==============================] - 3s 123ms/step - loss: 0.1945 - accurac
y: 0.9381 - val_loss: 1.5700 - val_accuracy: 0.6952
Epoch 69/100
27/27 [==============================] - 4s 129ms/step - loss: 0.1908 - accurac
y: 0.9440 - val_loss: 1.4014 - val_accuracy: 0.7000
Epoch 70/100
27/27 [==============================] - 3s 124ms/step - loss: 0.1629 - accurac
y: 0.9512 - val_loss: 1.5073 - val_accuracy: 0.6857
Epoch 71/100
27/27 [==============================] - 3s 130ms/step - loss: 0.1696 - accurac
y: 0.9446 - val_loss: 1.6471 - val_accuracy: 0.6762
Epoch 72/100
27/27 [==============================] - 3s 124ms/step - loss: 0.1943 - accurac
y: 0.9333 - val_loss: 1.5136 - val_accuracy: 0.6833
Epoch 73/100
27/27 [==============================] - 3s 124ms/step - loss: 0.1853 - accurac
y: 0.9375 - val_loss: 1.4903 - val_accuracy: 0.6786
Epoch 74/100
27/27 [==============================] - 3s 126ms/step - loss: 0.1332 - accurac
y: 0.9571 - val_loss: 1.3821 - val_accuracy: 0.6929
Epoch 75/100
27/27 [==============================] - 3s 123ms/step - loss: 0.1422 - accurac
y: 0.9470 - val_loss: 1.4623 - val_accuracy: 0.6833
Epoch 76/100
27/27 [==============================] - 3s 123ms/step - loss: 0.1508 - accurac
y: 0.9524 - val_loss: 1.9678 - val_accuracy: 0.6667
Epoch 77/100
27/27 [==============================] - 3s 125ms/step - loss: 0.1595 - accurac
y: 0.9476 - val_loss: 1.5533 - val_accuracy: 0.6571
Epoch 78/100
27/27 [==============================] - 3s 123ms/step - loss: 0.1657 - accurac
y: 0.9405 - val_loss: 1.5412 - val_accuracy: 0.6786
Epoch 79/100
27/27 [==============================] - 3s 124ms/step - loss: 0.1305 - accurac
y: 0.9560 - val_loss: 1.5258 - val_accuracy: 0.6929
Epoch 80/100
27/27 [==============================] - 3s 125ms/step - loss: 0.1341 - accurac
y: 0.9548 - val_loss: 1.5200 - val_accuracy: 0.6976
Epoch 81/100
27/27 [==============================] - 3s 122ms/step - loss: 0.1416 - accurac
y: 0.9542 - val_loss: 1.4684 - val_accuracy: 0.6905
Epoch 82/100
27/27 [==============================] - 3s 126ms/step - loss: 0.1554 - accurac
y: 0.9500 - val_loss: 1.4419 - val_accuracy: 0.7095
Epoch 83/100
```

```
27/27 [==============================] - 3s 124ms/step - loss: 0.1544 - accurac
y: 0.9476 - val_loss: 1.7372 - val_accuracy: 0.6786
Epoch 84/100
27/27 [==============================] - 3s 124ms/step - loss: 0.1755 - accurac
y: 0.9423 - val_loss: 1.5155 - val_accuracy: 0.6976
Epoch 85/100
27/27 [==============================] - 4s 130ms/step - loss: 0.1759 - accurac
y: 0.9435 - val_loss: 1.4334 - val_accuracy: 0.6714
Epoch 86/100
27/27 [==============================] - 3s 124ms/step - loss: 0.1684 - accurac
y: 0.9429 - val_loss: 1.7964 - val_accuracy: 0.6571
Epoch 87/100
27/27 [==============================] - 3s 124ms/step - loss: 0.1530 - accurac
y: 0.9530 - val_loss: 1.3789 - val_accuracy: 0.7071
Epoch 88/100
27/27 [==============================] - 3s 123ms/step - loss: 0.1504 - accurac
y: 0.9524 - val_loss: 1.3691 - val_accuracy: 0.7071
Epoch 89/100
27/27 [==============================] - 3s 123ms/step - loss: 0.1365 - accurac
y: 0.9589 - val_loss: 1.7462 - val_accuracy: 0.6738
Epoch 90/100
27/27 [==============================] - 3s 125ms/step - loss: 0.1495 - accurac
y: 0.9536 - val_loss: 1.4059 - val_accuracy: 0.6976
Epoch 91/100
27/27 [==============================] - 3s 124ms/step - loss: 0.1081 - accurac
y: 0.9661 - val_loss: 1.6802 - val_accuracy: 0.6976
Epoch 92/100
27/27 [==============================] - 3s 123ms/step - loss: 0.1422 - accurac
y: 0.9536 - val_loss: 1.3445 - val_accuracy: 0.6976
Epoch 93/100
27/27 [==============================] - 3s 126ms/step - loss: 0.1622 - accurac
y: 0.9464 - val_loss: 1.4001 - val_accuracy: 0.6905
Epoch 94/100
27/27 [==============================] - 3s 124ms/step - loss: 0.1106 - accurac
y: 0.9595 - val_loss: 1.5018 - val_accuracy: 0.7071
Epoch 95/100
27/27 [==============================] - 4s 127ms/step - loss: 0.1392 - accurac
y: 0.9536 - val_loss: 1.5660 - val_accuracy: 0.7119
Epoch 96/100
27/27 [==============================] - 4s 127ms/step - loss: 0.1253 - accurac
y: 0.9554 - val_loss: 1.3837 - val_accuracy: 0.7286
Epoch 97/100
27/27 [==============================] - 3s 127ms/step - loss: 0.1623 - accurac
y: 0.9464 - val_loss: 1.8481 - val_accuracy: 0.6524
Epoch 98/100
27/27 [==============================] - 4s 130ms/step - loss: 0.1401 - accurac
y: 0.9530 - val_loss: 1.5852 - val_accuracy: 0.6643
Epoch 99/100
27/27 [==============================] - 3s 124ms/step - loss: 0.1174 - accurac
y: 0.9601 - val_loss: 1.7381 - val_accuracy: 0.6786
Epoch 100/100
27/27 [==============================] - 3s 124ms/step - loss: 0.1216 - accurac
y: 0.9536 - val_loss: 1.4453 - val_accuracy: 0.7095
```

In [27]:

```python
#Let's visualize the results
def plot_training_results(history):
    """
    Visualize results of the model training using `matplotlib`.

    The visualization will include charts for accuracy and loss.
```

```
    on the training and as well as validation data sets.

    INPUTS:
        history(tf.keras.callbacks.History):
            Contains data on how the model metrics changed
            over the course of training.

    OUTPUTS:
        None.
    """
    # Get accuracy for training and validation sets
    accuracy = history.history['accuracy']
    validation_accuracy = history.history['val_accuracy']

    # Get loss for training and validation sets
    loss = history.history['loss']
    validation_loss = history.history['val_loss']

    # Get range of epochs to produce common plotting range
    epochs_range = range(epochs)

    # Instantiate plotting figure space
    plt.figure(figsize=(20, 8))

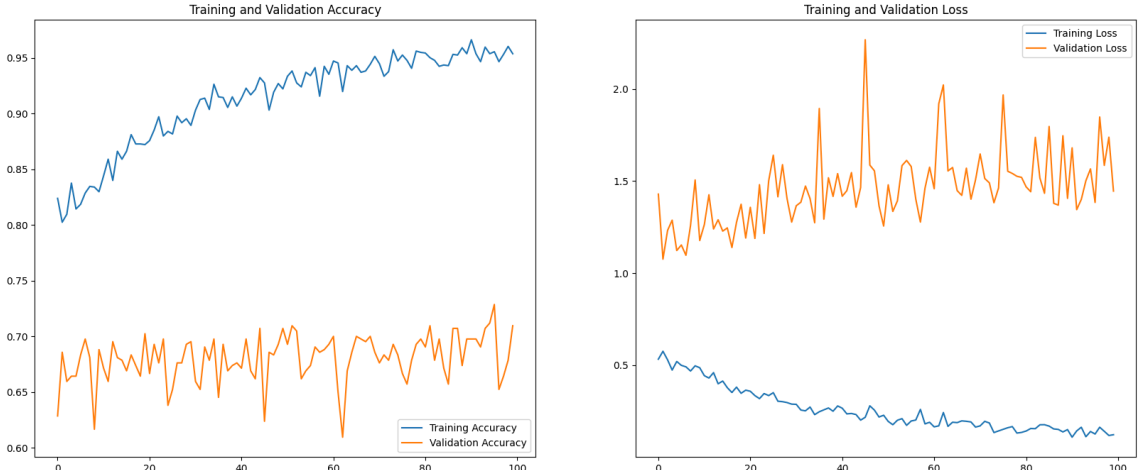
    # Create training/validation accuracy subplot
    plt.subplot(1, 2, 1)
    plt.plot(epochs_range, accuracy, label='Training Accuracy')
    plt.plot(epochs_range, validation_accuracy, label='Validation Accuracy')
    plt.legend(loc='lower right')
    plt.title('Training and Validation Accuracy')

    # Create training/validation loss subplot
    plt.subplot(1, 2, 2)
    plt.plot(epochs_range, loss, label='Training Loss')
    plt.plot(epochs_range, validation_loss, label='Validation Loss')
    plt.legend(loc='upper right')
    plt.title('Training and Validation Loss')

    # Render visualization
    plt.show()
```

In [28]:

```
# Visualize accuracy and loss for training and validation datasets
plot_training_results(history)
```



In [29]:

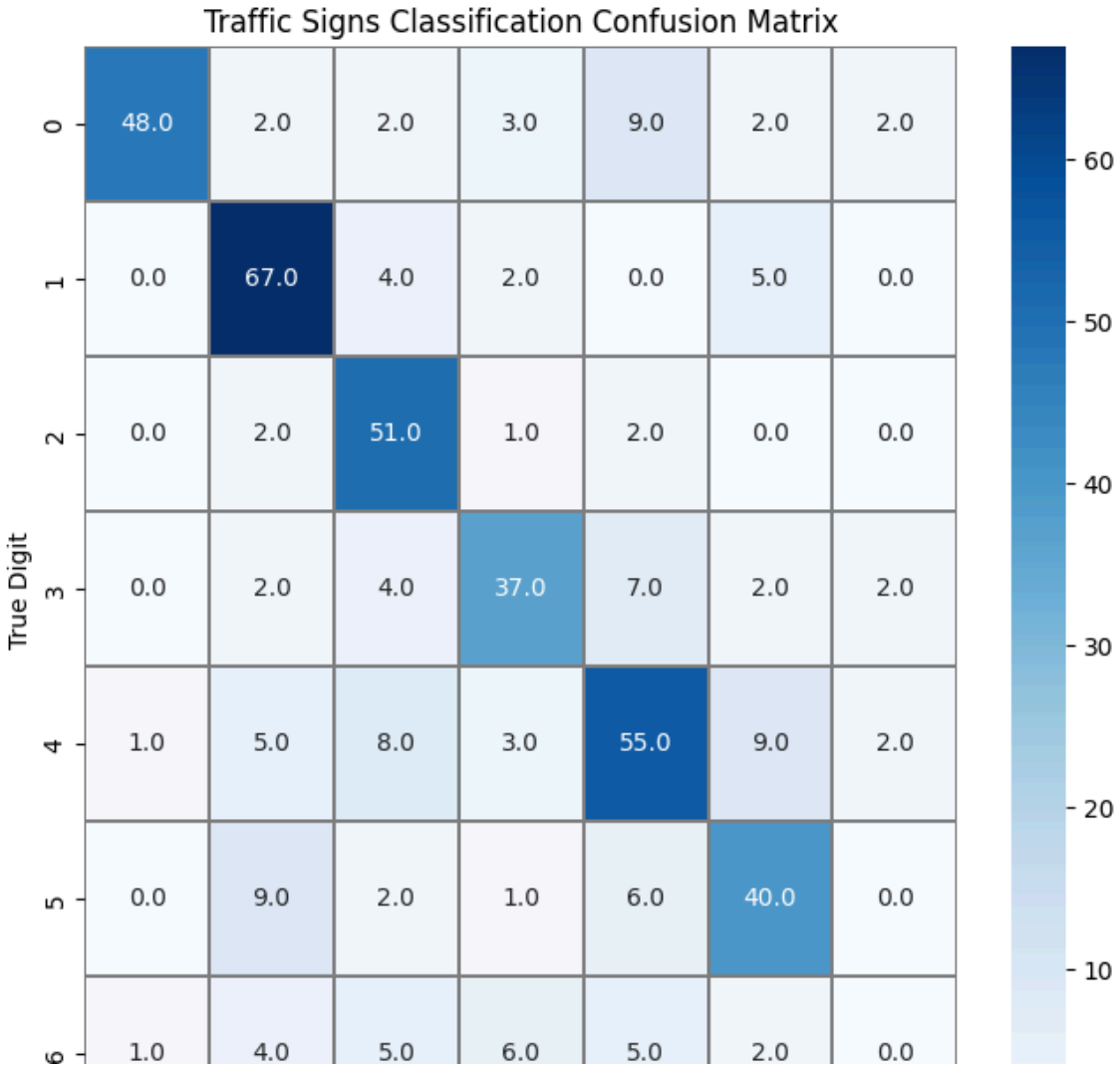
```
# Get predicted class values from fitted model
y_pred = model.predict(X_test_cnn)

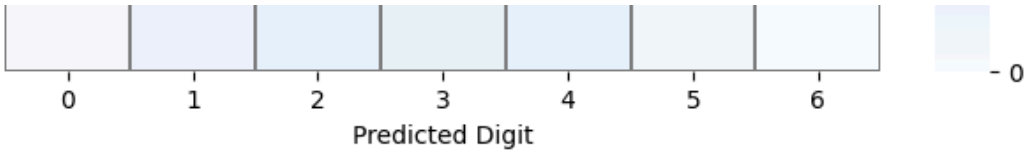
# Get class distributions for predicted and true class values
y_pred_classes =  np.argmax(y_pred, axis=1)
y_true =          np.argmax(y_test_cnn, axis=1)

# Create confusion matrix object from class distributions
cmat = confusion_matrix(y_true, y_pred_classes)

# Render confusion matrix as heatmap visualization
figure, axis = plt.subplots(figsize=(8, 8))
sns.heatmap(cmat,
            annot=True,
            linewidths=0.01,
            cmap="Blues",
            linecolor="gray",
            fmt=".1f",
            ax=axis)
plt.xlabel("Predicted Digit")
plt.ylabel("True Digit")
plt.title("Traffic Signs Classification Confusion Matrix")
plt.show()
```

```
14/14 [==============================] - 0s 28ms/step
```





The CNN network did a good job predicting classes that had only 1 object in it (such as one car, truck, bus, motorcycle etc.), but as soon as I introduced multiclass images (such as car, motorcycle, truck all in one image), it could not pick it up at all. So although it did good, it's not very practical for real world use. Therefore, I will work on training a custom YOLO v8 detection model.

Section 3: YOLO Model Training

In this section, I will organize my data in a format that is appropriate for the YOLO model. This will entail putting all of the class images into one folder for training, one folder for validation, and going through each images JSON file to get the class of the corresponding image and the dimensions of where the bounding box should go so the model can learn for both training and validation images. Lets get started.

In [13]:
```
static_directory = Path(r"C:\Users\chris\Desktop\capstone project\Traffic_Veh
```

In [36]:
```
#Here I am going through all of the annotation files and and getting the coor
# It will be normalized so the model can interpret it.


# Set paths
class_directories = {
    'bus': bus_path,
    'car': cars_path,
    'motorcycles': motorcycles_path,
    'threewheel': threewheels_path,
    'truck': trucks_path,
    'van': vans_path,
    'annotations': annotations_path
}

#Ensure output folder exists Note: Please update the static directory to a  p
output_folder = static_directory / "train" / "yolo_annotations"
os.makedirs(output_folder, exist_ok=True)

#Define the label mapping (YOLO requires numerical labels)
class_label_mapping = {
    'bus': 0,
    'car': 1,
    'motorbike': 2,
    'threewheel': 3,
    'truck': 4,
    'van': 5,
}
```

```
#Loop through all JSON files in the annotations folder
for json_file in os.listdir(class_directories['annotations']):
    if json_file.endswith('.json'):
        json_path = os.path.join(class_directories['annotations'], json_file)

        # Load the JSON data
        with open(json_path, 'r') as f:
            data = json.load(f)

        # Get image dimensions
        img_height = data['size']['height']
        img_width = data['size']['width']

        # Prepare to write to a YOLO annotation file
        txt_file = os.path.join(output_folder, json_file.replace('.json', '.t

        # Open the output file to write the annotations
        with open(txt_file, 'w') as txt_out:
            # Track unique classes in this file
            unique_classes = []

            # First pass to collect unique classes
            for obj in data['objects']:
                class_title = obj['classTitle']
                if class_title in class_label_mapping:
                    unique_classes.append(class_title)

            # Second pass to write annotations
            for obj in data['objects']:
                class_title = obj['classTitle']

                if class_title in class_label_mapping:
                    class_id = class_label_mapping[class_title]

                    # Extract bounding box points
                    x_min, y_min = obj['points']['exterior'][0]
                    x_max, y_max = obj['points']['exterior'][1]

                    # Normalize coordinates (YOLO expects values between 0 an
                    center_x = (x_min + x_max) / 2 / img_width
                    center_y = (y_min + y_max) / 2 / img_height
                    width = (x_max - x_min) / img_width
                    height = (y_max - y_min) / img_height

                    # If more than one unique class, write each class separat
                    if len(set(unique_classes)) > 1:
                        # Write entry for the actual class ID
                        txt_out.write(f"{class_id} {center_x:.6f} {center_y:.
                    else:
                        # Write normally for single class
                        txt_out.write(f"{class_id} {center_x:.6f} {center_y:.
```

I also have to do the same with the validation images.

In [2]:

```
# Paths for validation annotations and images
validation_annotations_path = static_directory / "valid" / "ann"
validation_images_path = static_directory / "valid" / "images"
```

```
# Ensure output folder for validation annotations exists
validation_output_folder = static_directory / "valid" / "yolo_annotations"
os.makedirs(validation_output_folder, exist_ok=True)

# Define the label mapping (YOLO requires numerical labels)
class_label_mapping = {
    'bus': 0,
    'car': 1,
    'motorbike': 2,
    'threewheel': 3,
    'truck': 4,
    'van': 5,
}

# Loop through all JSON files in the validation annotations folder
for json_file in os.listdir(validation_annotations_path):
    if json_file.endswith('.json'):
        json_path = os.path.join(validation_annotations_path, json_file)

        # Load the JSON data
        with open(json_path, 'r') as f:
            data = json.load(f)

        # Get image dimensions
        img_height = data['size']['height']
        img_width = data['size']['width']

        # Prepare to write to a YOLO annotation file for validation
        txt_file = os.path.join(validation_output_folder, json_file.replace('

        # Open the output file to write the annotations
        with open(txt_file, 'w') as txt_out:
            # Track unique classes in this file
            unique_classes = []

            # First pass to collect unique classes
            for obj in data['objects']:
                class_title = obj['classTitle']
                if class_title in class_label_mapping:
                    unique_classes.append(class_title)

            # Second pass to write annotations
            for obj in data['objects']:
                class_title = obj['classTitle']

                if class_title in class_label_mapping:
                    class_id = class_label_mapping[class_title]

                    # Extract bounding box points
                    x_min, y_min = obj['points']['exterior'][0]
                    x_max, y_max = obj['points']['exterior'][1]

                    # Normalize coordinates (YOLO expects values between 0 an
                    center_x = (x_min + x_max) / 2 / img_width
                    center_y = (y_min + y_max) / 2 / img_height
                    width = (x_max - x_min) / img_width
                    height = (y_max - y_min) / img_height

                    # If more than one unique class, write each class separat
                    if len(set(unique_classes)) > 1:
```

```
                        # Write entry for the actual class ID
                        txt_out.write(f"{class_id} {center_x:.6f} {center_y:.
                    else:
                        # Write normally for single class
                        txt_out.write(f"{class_id} {center_x:.6f} {center_y:.

print("Validation annotations processed and saved in YOLO format.")
```

```
Validation annotations processed and saved in YOLO format.
```

Because the images were saved as the images name.jpg or another format, I need to remove the file extension from the name so the YOLO model can work with the annotation text documents.

In [5]:

```
# Path for labels
label_folder = static_directory / "train" / "labels"

# Loop through all .txt files in the label folder
for filename in os.listdir(label_folder):
    # Check for and remove .jpg.txt, .jpeg.txt, and .png.txt extensions
    if filename.endswith('.jpg.txt'):
        new_filename = filename.replace('.jpg.txt', '.txt')
        os.rename(os.path.join(label_folder, filename), os.path.join(label_fo
    elif filename.endswith('.jpeg.txt'):
        new_filename = filename.replace('.jpeg.txt', '.txt')
        os.rename(os.path.join(label_folder, filename), os.path.join(label_fo
    elif filename.endswith('.png.txt'):
        new_filename = filename.replace('.png.txt', '.txt')
        os.rename(os.path.join(label_folder, filename), os.path.join(label_fo

print("Renaming complete!")
```

```
Renaming complete!
```

I will do the same with the validation image labels.

In [15]:

```
label_folder = static_directory / "valid" / "labels"
label_folder
```

Out[15]:

```
WindowsPath('C:/Users/chris/Desktop/capstone project/Traffic_Vehicle_Real_Tim
e_Detection/source/valid/labels')
```

In [18]:

```
# Path to your label folder (replace this with the actual path)
label_folder = static_directory / "valid" / "labels"

# Loop through all .txt files in the label folder
for filename in os.listdir(label_folder):
    # Check for and remove .jpg.txt, .jpeg.txt, and .png.txt extensions
    if filename.endswith('.jpg.txt'):
        new_filename = filename.replace('.jpg.txt', '.txt')
        os.rename(os.path.join(label_folder, filename), os.path.join(label_fo
    elif filename.endswith('.jpeg.txt'):
        new_filename = filename.replace('.jpeg.txt', '.txt')
```

```
        os.rename(os.path.join(label_folder, filename), os.path.join(label_fo
    elif filename.endswith('.png.txt'):
        new_filename = filename.replace('.png.txt', '.txt')
        os.rename(os.path.join(label_folder, filename), os.path.join(label_fo

print("Renaming complete!")
```

```
Renaming complete!
```

Now I will import the yolo model and train it on my dataset.

After training the model on my original image dataset, it did exceptionally well at identifying cars, motorcycles, trucks, vans, and tricycles. However, after introducing some images of buses, it was miscategorizing buses as trucks. As a result, I have went and found many more images of buses and trucks and trained the model on many more epochs to learn the interesting nuances of each class. The original dataset had trucks that were european style trucks, which are cabover style, which are very rectangular. This is likely making it difficult for the model to distinguish the differences between trucks and buses due to their similar shape and structure. As I have found more images to train the model on, I will retrain the model on more images and more epochs to evaluate how it will perform.

Below are the additional image datasets in which I have used to further train my model:

https://universe.roboflow.com/withaugmentation/buss_aug_train

https://universe.roboflow.com/aun-clavis/bus-yq0il

https://universe.roboflow.com/pruebas-de-200/truck-mx7ds

I will also have basic imports to train my yolo model below so I can quickly train it and evaluate the model

In [1]:
```
import torch
```

In [4]:
```
from ultralytics import YOLO

#Load the model
model = YOLO('yolov8n.pt')

#Train the model Note: Update the path to your local
model.train(data=static_directory / "data.yaml", epochs=400, imgsz=640)
```

```
New https://pypi.org/project/ultralytics/8.3.1 available  Update with 'pip inst
all -U ultralytics'
Ultralytics YOLOv8.2.100  Python-3.9.19 torch-2.0.0+cu117 CUDA:0 (NVIDIA GeForc
e RTX 3070 Laptop GPU, 8192MiB)
engine\trainer: task=detect, mode=train, model=yolov8n.pt, data=C:\Users\chris
\Desktop\capstone project\Traffic_Vehicle_Real_Time_Detection\source\data.yaml,
epochs=400, time=None, patience=100, batch=16, imgsz=640, save=True, save_perio
```

```
d=-1, cache=False, device=None, workers=8, project=None, name=train3, exist_ok=
False, pretrained=True, optimizer=auto, verbose=True, seed=0, deterministic=Tru
e, single_cls=False, rect=False, cos_lr=False, close_mosaic=10, resume=False, a
mp=True, fraction=1.0, profile=False, freeze=None, multi_scale=False, overlap_m
ask=True, mask_ratio=4, dropout=0.0, val=True, split=val, save_json=False, save
_hybrid=False, conf=None, iou=0.7, max_det=300, half=False, dnn=False, plots=Tr
ue, source=None, vid_stride=1, stream_buffer=False, visualize=False, augment=Fa
lse, agnostic_nms=False, classes=None, retina_masks=False, embed=None, show=Fal
se, save_frames=False, save_txt=False, save_conf=False, save_crop=False, show_l
abels=True, show_conf=True, show_boxes=True, line_width=None, format=torchscrip
t, keras=False, optimize=False, int8=False, dynamic=False, simplify=True, opset
=None, workspace=4, nms=False, lr0=0.01, lrf=0.01, momentum=0.937, weight_decay
=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warmup_bias_lr=0.1, box=7.5, c
ls=0.5, dfl=1.5, pose=12.0, kobj=1.0, label_smoothing=0.0, nbs=64, hsv_h=0.015,
hsv_s=0.7, hsv_v=0.4, degrees=0.0, translate=0.1, scale=0.5, shear=0.0, perspec
tive=0.0, flipud=0.0, fliplr=0.5, bgr=0.0, mosaic=1.0, mixup=0.0, copy_paste=0.
0, auto_augment=randaugment, erasing=0.4, crop_fraction=1.0, cfg=None, tracker=
botsort.yaml, save_dir=runs\detect\train3
Overriding model.yaml nc=80 with nc=6

                   from  n    params  module
arguments
  0                  -1  1       464  ultralytics.nn.modules.conv.Conv
[3, 16, 3, 2]
  1                  -1  1      4672  ultralytics.nn.modules.conv.Conv
[16, 32, 3, 2]
  2                  -1  1      7360  ultralytics.nn.modules.block.C2f
[32, 32, 1, True]
  3                  -1  1     18560  ultralytics.nn.modules.conv.Conv
[32, 64, 3, 2]
  4                  -1  2     49664  ultralytics.nn.modules.block.C2f
[64, 64, 2, True]
  5                  -1  1     73984  ultralytics.nn.modules.conv.Conv
[64, 128, 3, 2]
  6                  -1  2    197632  ultralytics.nn.modules.block.C2f
[128, 128, 2, True]
  7                  -1  1    295424  ultralytics.nn.modules.conv.Conv
[128, 256, 3, 2]
  8                  -1  1    460288  ultralytics.nn.modules.block.C2f
[256, 256, 1, True]
  9                  -1  1    164608  ultralytics.nn.modules.block.SPPF
[256, 256, 5]
 10                  -1  1         0  torch.nn.modules.upsampling.Upsample
[None, 2, 'nearest']
 11             [-1, 6]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 12                  -1  1    148224  ultralytics.nn.modules.block.C2f
[384, 128, 1]
 13                  -1  1         0  torch.nn.modules.upsampling.Upsample
[None, 2, 'nearest']
 14             [-1, 4]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 15                  -1  1     37248  ultralytics.nn.modules.block.C2f
[192, 64, 1]
 16                  -1  1     36992  ultralytics.nn.modules.conv.Conv
[64, 64, 3, 2]
 17            [-1, 12]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 18                  -1  1    123648  ultralytics.nn.modules.block.C2f
[192, 128, 1]
```

```
 19                  -1  1    147712  ultralytics.nn.modules.conv.Conv
[128, 128, 3, 2]
 20             [-1, 9]  1         0  ultralytics.nn.modules.conv.Concat
[1]
 21                  -1  1    493056  ultralytics.nn.modules.block.C2f
[384, 256, 1]
 22        [15, 18, 21]  1    752482  ultralytics.nn.modules.head.Detect
[6, [64, 128, 256]]
Model summary: 225 layers, 3,012,018 parameters, 3,012,002 gradients, 8.2 GFLOP
s

Transferred 319/355 items from pretrained weights
TensorBoard: Start with 'tensorboard --logdir runs\detect\train3', view at htt
p://localhost:6006/
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks with YOLOv8n...
AMP: checks passed

train: Scanning C:\Users\chris\Desktop\capstone project\Traffic_Vehicle_Real_Ti
me_Detection\source\train\labels... 2886 images, 1 backgrounds, 0 corrupt: 100%
|██████████| 2886/2886 [00:01<00:00, 2783.23it/s]
train: WARNING  C:\Users\chris\Desktop\capstone project\Traffic_Vehicle_Real_Ti
me_Detection\source\train\images\71b258004d677b5f_jpg.rf.bb24a02bf5f3f7b312d3f3
407bda46d9.jpg: 1 duplicate labels removed

train: New cache created: C:\Users\chris\Desktop\capstone project\Traffic_Vehic
le_Real_Time_Detection\source\train\labels.cache
WARNING  Box and segment counts should be equal, but got len(segments) = 247, l
en(boxes) = 3760. To resolve this only boxes will be used and all segments will
be removed. To avoid this please supply either a detect or segment dataset, not
a detect-segment mixed dataset.

val: Scanning C:\Users\chris\Desktop\capstone project\Traffic_Vehicle_Real_Time
_Detection\source\valid\labels... 936 images, 0 backgrounds, 0 corrupt: 100%|██
████████| 936/936 [00:00<00:00, 1357.13it/s]
val: New cache created: C:\Users\chris\Desktop\capstone project\Traffic_Vehicle
_Real_Time_Detection\source\valid\labels.cache
WARNING  Box and segment counts should be equal, but got len(segments) = 45, le
n(boxes) = 1195. To resolve this only boxes will be used and all segments will
be removed. To avoid this please supply either a detect or segment dataset, not
a detect-segment mixed dataset.
Plotting labels to runs\detect\train3\labels.jpg...
optimizer: 'optimizer=auto' found, ignoring 'lr0=0.01' and 'momentum=0.937' and
determining best 'optimizer', 'lr0' and 'momentum' automatically...
optimizer: SGD(lr=0.01, momentum=0.9) with parameter groups 57 weight(decay=0.
0), 64 weight(decay=0.0005), 63 bias(decay=0.0)
TensorBoard: model graph visualization added
Image sizes 640 train, 640 val
Using 8 dataloader workers
Logging results to runs\detect\train3
Starting training for 400 epochs...

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      1/400      2.15G     0.7394      2.585      1.246         21        640:
100%|██████████| 181/181 [00:19<00:00,  9.26it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  6.88it/s]
                   all        936       1195      0.647       0.74      0.757
0.625

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      2/400      2.14G     0.7747      1.633      1.238         22        640:
```

```
100%|██████████| 181/181 [00:17<00:00, 10.19it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.80it/s]
                   all        936       1195      0.767       0.76      0.838
0.677

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      3/400      2.14G     0.8285      1.488      1.261         21        640:
100%|██████████| 181/181 [00:22<00:00,  8.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.12it/s]
                   all        936       1195      0.749       0.71      0.792
0.599

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      4/400      2.14G      0.903      1.486      1.319         23        640:
100%|██████████| 181/181 [00:18<00:00,  9.99it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.66it/s]
                   all        936       1195      0.773       0.73      0.814
0.611

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      5/400      2.14G     0.8855      1.363      1.295         26        640:
100%|██████████| 181/181 [00:17<00:00, 10.26it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.75it/s]
                   all        936       1195      0.788      0.727      0.832
0.662

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      6/400      2.14G     0.8875       1.27      1.309         25        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.66it/s]
                   all        936       1195      0.775       0.76      0.827
0.68
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      7/400      2.14G     0.8513      1.159      1.272         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.18it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.93it/s]
                   all        936       1195      0.772      0.745      0.812
0.629
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      8/400      2.13G     0.8423      1.099      1.273         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.48it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.79it/s]
                   all        936       1195       0.81      0.745      0.844
0.645
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
      9/400      2.13G     0.8305      1.044      1.265         14        640:
100%|██████████| 181/181 [00:18<00:00,  9.68it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.84it/s]
                   all        936       1195      0.841      0.763      0.857
```

```
0.7

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     10/400      2.13G     0.8095     0.9872       1.25         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.48it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.00it/s]
                   all        936       1195      0.843      0.778      0.891
0.727

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     11/400      2.14G     0.8045     0.9706      1.239         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.27it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.89it/s]
                   all        936       1195      0.908      0.821      0.897
0.757

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     12/400      2.26G     0.7824     0.9416      1.227         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.33it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.21it/s]
                   all        936       1195      0.876      0.819      0.891
0.744

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     13/400      2.13G     0.7807     0.9168      1.229         19        640:
100%|██████████| 181/181 [00:19<00:00,  9.26it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.28it/s]
                   all        936       1195      0.871      0.815      0.897
0.762

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     14/400      2.13G     0.7569     0.8705      1.206         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.51it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.19it/s]
                   all        936       1195      0.889      0.853      0.925
0.778

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     15/400      2.13G     0.7603     0.8748      1.212         14        640:
100%|██████████| 181/181 [00:16<00:00, 10.74it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.22it/s]
                   all        936       1195      0.883      0.831      0.923
0.77

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     16/400      2.13G      0.751     0.8498      1.201         19        640:
100%|██████████| 181/181 [00:18<00:00,  9.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.29it/s]
                   all        936       1195      0.861       0.85      0.929
0.786

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     17/400      2.13G     0.7326     0.8382      1.191         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.50it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.44it/s]
                   all        936       1195      0.885      0.831      0.913
```

```
                   all        936       1195      0.936      0.844      0.937
0.803
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     19/400      2.27G     0.7178     0.7779      1.183         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.39it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.30it/s]
                   all        936       1195      0.925      0.872      0.947
0.817
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     20/400      2.13G     0.7379     0.8108      1.196         13        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.39it/s]
                   all        936       1195      0.923       0.88      0.942
0.806
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     21/400      2.13G     0.7038     0.7637       1.17         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.23it/s]
                   all        936       1195      0.927       0.88      0.943
0.81
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     22/400      2.13G     0.6992     0.7626      1.171         23        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.36it/s]
                   all        936       1195      0.918      0.891      0.946
0.81
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     23/400      2.13G     0.6997     0.7489       1.17         15        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.28it/s]
                   all        936       1195      0.944      0.877      0.948
0.821
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     24/400      2.13G     0.7006     0.7399      1.168         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.19it/s]
                   all        936       1195      0.912      0.854      0.934
0.793
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     25/400      2.13G      0.691     0.7203      1.165         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.20it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.29it/s]
```

```
                   all        936       1195      0.921      0.872      0.944
0.815

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     26/400      2.26G     0.6757     0.7146      1.151         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.40it/s]
                   all        936       1195      0.937      0.884      0.952
0.824

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     27/400      2.13G     0.6767     0.7109      1.151         25        640:
100%|██████████| 181/181 [00:18<00:00,  9.58it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.99it/s]
                   all        936       1195      0.932      0.882      0.953
0.837

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     28/400      2.13G     0.6733     0.7013      1.157         29        640:
100%|██████████| 181/181 [00:17<00:00, 10.17it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.35it/s]
                   all        936       1195      0.941      0.867      0.939
0.822

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     29/400      2.13G     0.6592     0.6735      1.146         25        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.20it/s]
                   all        936       1195      0.948      0.886      0.948
0.824

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     30/400      2.27G     0.6684     0.6843      1.145         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.07it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.40it/s]
                   all        936       1195      0.943      0.909      0.959
0.847

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     31/400      2.13G     0.6548     0.6769      1.143         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.28it/s]
                   all        936       1195      0.927      0.904      0.945
0.831

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     32/400      2.26G     0.6677     0.6826       1.15         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.22it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.40it/s]
                   all        936       1195      0.924        0.9      0.954
0.838

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     33/400      2.13G     0.6504     0.6711      1.138         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.17it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.38it/s]
```

```
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.38it/s]
                   all        936       1195      0.926      0.902      0.951
0.84

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     34/400      2.27G     0.6495     0.6637       1.14         15        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.35it/s]
                   all        936       1195      0.957      0.892       0.96
0.85

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     35/400      2.13G     0.6442     0.6504      1.135         15        640:
100%|██████████| 181/181 [00:17<00:00, 10.17it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.35it/s]
                   all        936       1195      0.953      0.907      0.962
0.853

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     36/400      2.13G     0.6375     0.6378      1.133         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.34it/s]
                   all        936       1195      0.928       0.92       0.96
0.85

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     37/400      2.13G     0.6307     0.6343      1.125         25        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.06it/s]
                   all        936       1195      0.964      0.899      0.962
0.849

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     38/400      2.13G     0.6304     0.6392      1.126         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.23it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.45it/s]
                   all        936       1195      0.942      0.896      0.951
0.839

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     39/400      2.13G     0.6283     0.6309      1.122         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.42it/s]
                   all        936       1195      0.953       0.89      0.956
0.847

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     40/400      2.13G      0.629     0.6118      1.118         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.24it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.09it/s]
                   all        936       1195      0.965      0.907      0.969
0.86

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     41/400      2.27G     0.6328     0.6246      1.122         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.16it/s]
                 Class     Images  Instances      Box(P          R      mAP50
```

```
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.43it/s]
                   all        936       1195      0.934      0.918      0.968
0.857

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     42/400      2.13G     0.6251     0.6159      1.121         15        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.38it/s]
                   all        936       1195      0.948      0.926      0.972
0.858

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     43/400      2.13G     0.6159     0.6019      1.111         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.13it/s]
                   all        936       1195      0.975      0.886      0.967
0.854

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     44/400      2.13G     0.6051     0.5919      1.112         22        640:
100%|██████████| 181/181 [00:19<00:00,  9.49it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.15it/s]
                   all        936       1195      0.954      0.894       0.96
0.854

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     45/400      2.13G     0.6037     0.5991      1.109         24        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.37it/s]
                   all        936       1195      0.953      0.899      0.963
0.859

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     46/400      2.13G     0.6178     0.5995       1.11         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.12it/s]
                   all        936       1195      0.952      0.906      0.959
0.849

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     47/400      2.13G     0.6045     0.5875      1.108         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.20it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.37it/s]
                   all        936       1195      0.965        0.9       0.96
0.858

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     48/400      2.13G      0.615     0.5914      1.111         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.41it/s]
                   all        936       1195      0.953      0.912      0.966
0.863

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     49/400      2.13G     0.6034     0.5844      1.109         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
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                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.37it/s]
                   all        936       1195      0.952      0.904      0.966
0.862

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     50/400      2.13G     0.6066     0.5853      1.113         23        640:
100%|██████████| 181/181 [00:18<00:00,  9.86it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.14it/s]
                   all        936       1195      0.952      0.896      0.963
0.857

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     51/400      2.13G     0.6075     0.5827       1.11         26        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.27it/s]
                   all        936       1195      0.964      0.904      0.967
0.862

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     52/400      2.13G      0.588     0.5643      1.096         21        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.39it/s]
                   all        936       1195      0.959      0.914      0.967
0.86

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     53/400      2.13G     0.5995     0.5696      1.099         11        640:
100%|██████████| 181/181 [00:17<00:00, 10.16it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.39it/s]
                   all        936       1195      0.956      0.896      0.958
0.863

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     54/400      2.13G      0.596     0.5752      1.101         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.13it/s]
                   all        936       1195      0.952      0.918      0.967
0.857

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     55/400      2.13G     0.5979     0.5669      1.103         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.21it/s]
                   all        936       1195      0.961      0.915      0.964
0.864

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     56/400      2.26G     0.5859     0.5527      1.099         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.36it/s]
                   all        936       1195      0.946      0.939       0.97
0.873

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     57/400      2.27G     0.5865     0.5729      1.098         15        640:
100%|██████████| 181/181 [00:18<00:00,  9.96it/s]
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                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.27it/s]
                   all        936       1195      0.956      0.925      0.966
0.866

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     58/400      2.13G     0.5861     0.5578        1.1         15        640:
100%|██████████| 181/181 [00:17<00:00, 10.22it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.12it/s]
                   all        936       1195      0.935      0.917      0.962
0.862

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     59/400      2.27G     0.5844     0.5467      1.097         13        640:
100%|██████████| 181/181 [00:17<00:00, 10.07it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.39it/s]
                   all        936       1195      0.955      0.903      0.963
0.867

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     60/400      2.13G     0.5655     0.5431      1.088         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.07it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.41it/s]
                   all        936       1195      0.942      0.932      0.969
0.875

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     61/400      2.13G     0.5818     0.5549      1.091         15        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.33it/s]
                   all        936       1195       0.96       0.91      0.967
0.865

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     62/400      2.13G     0.5767     0.5463       1.09         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.34it/s]
                   all        936       1195      0.958      0.918      0.969
0.877

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     63/400      2.13G     0.5803     0.5401      1.098         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195      0.942      0.917      0.967
0.872

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     64/400      2.13G     0.5704     0.5252      1.083         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.39it/s]
                   all        936       1195      0.958      0.929      0.968
0.871

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     65/400      2.26G     0.5674     0.5394      1.087         19        640:
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100%|██████████| 181/181 [00:18<00:00, 10.041t/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195      0.971      0.914      0.967
0.877

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     66/400      2.27G     0.5697     0.5317      1.091         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.38it/s]
                   all        936       1195      0.953      0.924      0.965
0.872

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     67/400      2.13G     0.5628      0.526      1.082         25        640:
100%|██████████| 181/181 [00:17<00:00, 10.17it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.38it/s]
                   all        936       1195      0.952      0.931      0.971
0.876

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     68/400      2.13G     0.5626     0.5296      1.084         21        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.36it/s]
                   all        936       1195      0.962       0.92       0.97
0.874

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     69/400      2.27G     0.5619     0.5289      1.087         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.20it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.38it/s]
                   all        936       1195      0.962      0.929      0.972
0.875

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     70/400      2.13G     0.5651     0.5282      1.086         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.23it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.34it/s]
                   all        936       1195      0.973      0.905      0.971
0.875

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     71/400      2.13G      0.559     0.5213      1.081         15        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.26it/s]
                   all        936       1195      0.948      0.931      0.973
0.879

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     72/400      2.13G     0.5616      0.525      1.075         25        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.51it/s]
                   all        936       1195      0.959      0.922      0.971
0.878

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     73/400      2.13G     0.5556     0.5167      1.078         17        640:
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100%|██████████| 181/181 [00:17<00:00, 10.18it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.40it/s]
                   all        936       1195       0.95      0.929      0.971
0.875

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     74/400      2.13G     0.5528     0.5031      1.074         28        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.46it/s]
                   all        936       1195      0.961      0.913      0.966
0.876

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     75/400      2.13G     0.5593      0.509       1.08         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.24it/s]
                   all        936       1195      0.958      0.941      0.975
0.885

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     76/400      2.26G     0.5431     0.4973      1.074         13        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.39it/s]
                   all        936       1195      0.944      0.934       0.97
0.879

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     77/400      2.13G     0.5468      0.503      1.073         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.38it/s]
                   all        936       1195      0.965      0.928      0.972
0.884

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     78/400      2.27G     0.5488     0.5002      1.068         13        640:
100%|██████████| 181/181 [00:18<00:00, 10.03it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.44it/s]
                   all        936       1195      0.953      0.929      0.969
0.874

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     79/400      2.13G     0.5531      0.503      1.072         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.24it/s]
                   all        936       1195      0.963      0.926      0.971
0.878

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     80/400      2.26G     0.5417     0.4953      1.064         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.37it/s]
                   all        936       1195      0.966      0.923      0.973
0.888

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
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     81/400      2.13G     0.5373     0.4938      1.067         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.39it/s]
                   all        936       1195      0.966      0.904      0.972
0.883

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     82/400      2.13G     0.5328      0.488      1.058         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.37it/s]
                   all        936       1195       0.96       0.93      0.974
0.885

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     83/400      2.13G     0.5424     0.4945      1.069         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.16it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.33it/s]
                   all        936       1195       0.97      0.923      0.975
0.886

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     84/400      2.13G      0.539     0.4986      1.069         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.08it/s]
                   all        936       1195      0.958      0.922      0.972
0.884

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     85/400      2.13G     0.5277     0.4844      1.059         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.17it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.48it/s]
                   all        936       1195      0.964      0.924       0.97
0.885

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     86/400      2.26G     0.5349     0.4813      1.061         21        640:
100%|██████████| 181/181 [00:18<00:00, 10.03it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.34it/s]
                   all        936       1195       0.96      0.925      0.972
0.883

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     87/400      2.26G     0.5374      0.476      1.066         24        640:
100%|██████████| 181/181 [00:17<00:00, 10.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.04it/s]
                   all        936       1195      0.961      0.937      0.972
0.882

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     88/400      2.13G     0.5363     0.4853      1.063         24        640:
100%|██████████| 181/181 [00:17<00:00, 10.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.45it/s]
                   all        936       1195      0.962      0.926      0.975
0.885

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
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     89/400      2.13G     0.5345     0.4889      1.061         14        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195      0.958      0.919      0.969
0.883

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     90/400      2.27G     0.5284     0.4784      1.058         23        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.23it/s]
                   all        936       1195      0.965      0.932      0.972
0.885

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     91/400      2.13G     0.5284     0.4732      1.059         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195      0.956      0.927      0.969
0.88

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     92/400      2.26G     0.5272     0.4886      1.055         23        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.50it/s]
                   all        936       1195      0.964      0.946      0.977
0.889

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     93/400      2.13G      0.527     0.4722      1.058         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.18it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.38it/s]
                   all        936       1195      0.959      0.933      0.975
0.885

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     94/400      2.13G     0.5174     0.4637      1.049         24        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.29it/s]
                   all        936       1195      0.967       0.92      0.972
0.883

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     95/400      2.13G      0.526     0.4686      1.058         20        640:
100%|██████████| 181/181 [00:18<00:00, 10.03it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.27it/s]
                   all        936       1195      0.957      0.937      0.975
0.888

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     96/400      2.13G     0.5166     0.4653      1.053         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.18it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.21it/s]
                   all        936       1195      0.963      0.932      0.973
0.884
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      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     97/400      2.13G     0.5155     0.4698      1.052         21        640:
100%|██████████| 181/181 [00:18<00:00,  9.72it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.46it/s]
                   all        936       1195      0.963      0.932      0.975
0.882

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     98/400      2.13G     0.5186     0.4655      1.046         28        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  6.09it/s]
                   all        936       1195      0.968      0.924       0.97
0.881

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     99/400      2.27G     0.5121     0.4499      1.048         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.10it/s]
                   all        936       1195      0.963      0.936      0.974
0.887

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    100/400      2.13G      0.514     0.4625      1.053         17        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.41it/s]
                   all        936       1195      0.974      0.929      0.977
0.888

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    101/400      2.13G      0.508      0.459      1.043         15        640:
100%|██████████| 181/181 [00:18<00:00,  9.92it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.27it/s]
                   all        936       1195      0.977      0.937      0.977
0.894

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    102/400      2.13G     0.5131     0.4603      1.052         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.22it/s]
                   all        936       1195      0.965       0.93      0.974
0.89

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    103/400      2.13G     0.5159     0.4607      1.048         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.26it/s]
                   all        936       1195      0.967       0.93      0.974
0.884

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    104/400      2.13G     0.5112     0.4523      1.049         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.18it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.47it/s]
                   all        936       1195      0.966      0.935      0.976
0.89
```

```
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    105/400      2.13G     0.5013     0.4524      1.043         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.99it/s]
                   all        936       1195      0.962       0.93      0.972
0.891

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    106/400      2.13G     0.5098     0.4517      1.046         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.24it/s]
                   all        936       1195      0.948      0.927      0.973
0.892

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    107/400      2.13G     0.5077     0.4533      1.044         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.07it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.47it/s]
                   all        936       1195       0.96      0.928      0.971
0.883

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    108/400      2.26G     0.5062     0.4471      1.045         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.31it/s]
                   all        936       1195      0.959      0.928      0.972
0.891

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    109/400      2.13G     0.5153     0.4479      1.048         17        640:
100%|██████████| 181/181 [00:18<00:00, 10.02it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.40it/s]
                   all        936       1195      0.957      0.936      0.974
0.889

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    110/400      2.13G     0.5017     0.4371      1.041         15        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.33it/s]
                   all        936       1195      0.957      0.923      0.969
0.884

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    111/400      2.13G     0.5092     0.4488      1.043         23        640:
100%|██████████| 181/181 [00:17<00:00, 10.16it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.30it/s]
                   all        936       1195      0.958      0.922      0.973
0.885

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    112/400      2.13G     0.5012     0.4441      1.041         21        640:
100%|██████████| 181/181 [00:18<00:00,  9.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.43it/s]
                   all        936       1195      0.963      0.936      0.976
0.887
```

```
0.887
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    113/400      2.13G     0.5026     0.4434      1.044         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.07it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.42it/s]
                   all        936       1195      0.954      0.935      0.972
0.889
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    114/400      2.13G     0.4941     0.4394      1.035         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.40it/s]
                   all        936       1195      0.968      0.931      0.971
0.89
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    115/400      2.13G     0.5048     0.4436      1.041         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.45it/s]
                   all        936       1195      0.954       0.94      0.975
0.892
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    116/400      2.13G     0.4988     0.4401      1.043         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.27it/s]
                   all        936       1195      0.959       0.93      0.975
0.893
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    117/400      2.13G     0.4968     0.4401      1.038         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.36it/s]
                   all        936       1195      0.969      0.937      0.974
0.892
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    118/400      2.13G     0.4961     0.4328      1.035         19        640:
100%|██████████| 181/181 [00:18<00:00, 10.01it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.35it/s]
                   all        936       1195       0.95      0.941      0.972
0.892
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    119/400      2.13G     0.4974     0.4297      1.035         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.34it/s]
                   all        936       1195      0.971      0.921      0.975
0.898
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    120/400      2.26G     0.4929     0.4378      1.037         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195       0.97      0.937      0.974
```

```
0.899

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    121/400      2.27G     0.4844     0.4268      1.032         14        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.43it/s]
                   all        936       1195      0.968       0.93      0.974
0.89

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    122/400      2.13G       0.49     0.4287      1.036         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.91it/s]
                   all        936       1195      0.971      0.923      0.975
0.895

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    123/400      2.13G     0.5014     0.4432      1.038         21        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.37it/s]
                   all        936       1195      0.977      0.929      0.978
0.899

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    124/400      2.13G     0.4963     0.4308      1.034         11        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.39it/s]
                   all        936       1195      0.976      0.933      0.975
0.896

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    125/400      2.13G      0.491     0.4367      1.036         18        640:
100%|██████████| 181/181 [00:18<00:00, 10.00it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.25it/s]
                   all        936       1195       0.97       0.93      0.975
0.894

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    126/400      2.13G     0.4919     0.4243      1.037         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.56it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.38it/s]
                   all        936       1195      0.973      0.929      0.977
0.896

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    127/400      2.13G     0.4848     0.4294      1.032         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.58it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.52it/s]
                   all        936       1195      0.975      0.915      0.974
0.893

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    128/400      2.13G     0.4873     0.4179      1.035         17        640:
100%|██████████| 181/181 [00:16<00:00, 10.70it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.16it/s]
                   all        936       1195      0.957      0.943      0.975
```

```
                 all        936       1195      0.957      0.943      0.975
0.897

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    129/400      2.13G     0.4866      0.417      1.035         14        640:
100%|██████████| 181/181 [00:16<00:00, 10.69it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.46it/s]
                 all        936       1195      0.968      0.936      0.977
0.894

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    130/400      2.13G     0.4831     0.4249      1.027         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.62it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.40it/s]
                 all        936       1195      0.974      0.927      0.975
0.891

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    131/400      2.13G     0.4818     0.4179       1.03         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.64it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.30it/s]
                 all        936       1195      0.967      0.937      0.975
0.895

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    132/400      2.13G      0.486     0.4191      1.035         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.54it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.37it/s]
                 all        936       1195      0.964      0.939      0.976
0.896

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    133/400      2.26G     0.4876     0.4259      1.031         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.48it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.28it/s]
                 all        936       1195      0.973      0.934      0.976
0.894

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    134/400      2.26G     0.4814     0.4168      1.029         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.41it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.31it/s]
                 all        936       1195      0.965      0.932      0.972
0.892

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    135/400      2.13G     0.4792     0.4165      1.026         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.50it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.43it/s]
                 all        936       1195      0.977      0.926      0.977
0.895

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    136/400      2.13G     0.4817     0.4142      1.029         17        640:
100%|██████████| 181/181 [00:16<00:00, 10.66it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.13it/s]
```

```
                   all        936       1195      0.975      0.927      0.975
0.898

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    137/400      2.27G     0.4839     0.4133      1.023         23        640:
100%|██████████| 181/181 [00:17<00:00, 10.55it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.35it/s]
                   all        936       1195      0.977       0.93      0.976
0.897

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    138/400      2.13G     0.4764     0.4102      1.028         16        640:
100%|██████████| 181/181 [00:16<00:00, 10.65it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.32it/s]
                   all        936       1195      0.973      0.933      0.975
0.897

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    139/400      2.13G     0.4717     0.4038       1.02         25        640:
100%|██████████| 181/181 [00:17<00:00, 10.63it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.38it/s]
                   all        936       1195      0.972      0.934      0.977
0.899

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    140/400      2.13G     0.4806     0.4183      1.029         24        640:
100%|██████████| 181/181 [00:17<00:00, 10.47it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.35it/s]
                   all        936       1195       0.97      0.937      0.978
0.9

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    141/400      2.13G     0.4788     0.4079      1.026         12        640:
100%|██████████| 181/181 [00:17<00:00, 10.60it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.96it/s]
                   all        936       1195      0.974      0.929      0.977
0.899

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    142/400      2.27G     0.4664     0.4059      1.023         16        640:
100%|██████████| 181/181 [00:16<00:00, 10.66it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.24it/s]
                   all        936       1195      0.958      0.947      0.979
0.901

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    143/400      2.27G     0.4753     0.4027      1.022         24        640:
100%|██████████| 181/181 [00:17<00:00, 10.53it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.36it/s]
                   all        936       1195      0.972      0.941      0.977
0.901

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    144/400      2.13G     0.4736     0.4061      1.022         21        640:
100%|██████████| 181/181 [00:16<00:00, 10.68it/s]
                 Class     Images  Instances      Box(P          R      mAP50
```

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mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.32it/s]
                   all        936       1195      0.978      0.928      0.976
0.897

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    145/400      2.13G     0.4734     0.4066      1.024         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.53it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.28it/s]
                   all        936       1195      0.974      0.933      0.977
0.895

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    146/400      2.13G     0.4746     0.4153      1.018         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.51it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.19it/s]
                   all        936       1195      0.973      0.931      0.976
0.896

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    147/400      2.13G      0.474     0.4086      1.026         27        640:
100%|██████████| 181/181 [00:16<00:00, 10.68it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.20it/s]
                   all        936       1195      0.966      0.937      0.975
0.895

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    148/400      2.13G     0.4723     0.4026      1.024         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.60it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.34it/s]
                   all        936       1195      0.975      0.928      0.975
0.9

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    149/400      2.13G     0.4671      0.401      1.025         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.64it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.77it/s]
                   all        936       1195      0.982      0.931      0.977
0.9

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    150/400      2.13G     0.4741     0.4129      1.024         19        640:
100%|██████████| 181/181 [00:16<00:00, 10.69it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.29it/s]
                   all        936       1195      0.973      0.933      0.976
0.899

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    151/400      2.27G     0.4645     0.3966      1.021         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.62it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.31it/s]
                   all        936       1195      0.974       0.93      0.975
0.898

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    152/400      2.26G     0.4672     0.3981      1.017         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.64it/s]
                 Class     Images  Instances      Box(P          R      mAP50
```

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mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.41it/s]
                   all        936       1195       0.96      0.934      0.974
0.896

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    153/400      2.13G     0.4676     0.4008      1.023         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.64it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.36it/s]
                   all        936       1195      0.977      0.928      0.977
0.899

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    154/400      2.13G     0.4705     0.4118      1.025         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.47it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.30it/s]
                   all        936       1195      0.974      0.942       0.98
0.904

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    155/400      2.13G     0.4645     0.3934       1.02         16        640:
100%|██████████| 181/181 [00:16<00:00, 10.66it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.34it/s]
                   all        936       1195      0.975      0.927      0.978
0.904

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    156/400      2.13G     0.4649     0.3882      1.017         25        640:
100%|██████████| 181/181 [00:17<00:00, 10.50it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.51it/s]
                   all        936       1195      0.962      0.943      0.977
0.9

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    157/400      2.13G      0.464     0.3909      1.013         18        640:
100%|██████████| 181/181 [00:16<00:00, 10.65it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.92it/s]
                   all        936       1195       0.97      0.934      0.977
0.902

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    158/400      2.13G     0.4609     0.3917      1.017         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.60it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.44it/s]
                   all        936       1195      0.963      0.933      0.974
0.9

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    159/400      2.13G     0.4635     0.3821      1.018         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.52it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.22it/s]
                   all        936       1195      0.975      0.923      0.975
0.898

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    160/400      2.13G     0.4667     0.3908      1.019         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.30it/s]
```

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                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.27it/s]
                   all        936       1195      0.976      0.922      0.975
0.899

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    161/400      2.26G     0.4641     0.3932      1.016         23        640:
100%|██████████| 181/181 [00:17<00:00, 10.57it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.45it/s]
                   all        936       1195      0.973      0.928      0.977
0.901

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    162/400      2.13G     0.4589      0.394      1.021         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.57it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.16it/s]
                   all        936       1195      0.967      0.933      0.975
0.897

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    163/400      2.26G     0.4588      0.388      1.011         21        640:
100%|██████████| 181/181 [00:18<00:00,  9.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.45it/s]
                   all        936       1195      0.973      0.928      0.978
0.903

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    164/400      2.13G     0.4608     0.3857      1.017         17        640:
100%|██████████| 181/181 [00:18<00:00,  9.99it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.22it/s]
                   all        936       1195      0.981      0.924      0.979
0.905

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    165/400      2.26G      0.461     0.3892      1.012         11        640:
100%|██████████| 181/181 [00:16<00:00, 10.67it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.01it/s]
                   all        936       1195      0.979      0.926      0.978
0.902

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    166/400      2.27G     0.4595     0.3866      1.015         13        640:
100%|██████████| 181/181 [00:17<00:00, 10.59it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.41it/s]
                   all        936       1195      0.972      0.935      0.977
0.902

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    167/400      2.13G     0.4489      0.382      1.008         20        640:
100%|██████████| 181/181 [00:16<00:00, 10.71it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.32it/s]
                   all        936       1195      0.976      0.932      0.976
0.899

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    168/400      2.13G      0.446     0.3756      1.009         25        640:
100%|██████████| 181/181 [00:16<00:00, 10.68it/s]
```

```
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.26it/s]
                   all        936       1195       0.97      0.935      0.977
0.901

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    169/400      2.13G     0.4425     0.3759      1.005         11        640:
100%|██████████| 181/181 [00:17<00:00, 10.47it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.33it/s]
                   all        936       1195      0.973      0.937      0.977
0.903

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    170/400      2.26G     0.4548     0.3749      1.009         23        640:
100%|██████████| 181/181 [00:17<00:00, 10.60it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.15it/s]
                   all        936       1195      0.968      0.936      0.979
0.904

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    171/400      2.26G     0.4521     0.3758      1.017         18        640:
100%|██████████| 181/181 [00:16<00:00, 10.66it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.44it/s]
                   all        936       1195      0.981      0.932      0.978
0.901

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    172/400      2.13G      0.447     0.3812       1.01         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.53it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.28it/s]
                   all        936       1195      0.977      0.932      0.977
0.901

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    173/400      2.13G     0.4512     0.3784      1.009         12        640:
100%|██████████| 181/181 [00:16<00:00, 10.69it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.07it/s]
                   all        936       1195      0.971       0.94      0.977
0.902

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    174/400      2.13G     0.4502     0.3804      1.017         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.56it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.34it/s]
                   all        936       1195       0.97      0.944      0.976
0.903

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    175/400      2.13G     0.4592     0.3906      1.015         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.46it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.29it/s]
                   all        936       1195      0.975      0.945      0.978
0.904

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    176/400      2.13G     0.4532     0.3734      1.011         22        640:
```

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100%|██████████| 181/181 [00:16<00:00, 10.68it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.41it/s]
                   all        936       1195      0.976      0.941      0.977
0.903

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    177/400      2.13G     0.4448     0.3745      1.007         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.57it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.45it/s]
                   all        936       1195      0.971      0.943      0.978
0.904

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    178/400      2.13G      0.443     0.3683       1.01         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.57it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.20it/s]
                   all        936       1195      0.973      0.938      0.977
0.9

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    179/400      2.13G     0.4429     0.3702      1.006         18        640:
100%|██████████| 181/181 [00:16<00:00, 10.66it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.27it/s]
                   all        936       1195      0.974      0.931      0.977
0.901

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    180/400      2.13G     0.4429     0.3666      1.006         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.52it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.16it/s]
                   all        936       1195      0.978      0.922      0.975
0.899

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    181/400      2.27G     0.4483     0.3722       1.01         16        640:
100%|██████████| 181/181 [00:16<00:00, 10.66it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.38it/s]
                   all        936       1195      0.982      0.915      0.976
0.9

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    182/400      2.13G     0.4389     0.3668     0.9995         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.62it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.35it/s]
                   all        936       1195      0.961      0.938      0.977
0.902

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    183/400      2.13G     0.4414     0.3696      1.003         23        640:
100%|██████████| 181/181 [00:17<00:00, 10.51it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.32it/s]
                   all        936       1195      0.966      0.938      0.976
0.904

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    184/400      2.26G     0.4387     0.3664          1         20        640:
```

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100%|██████████| 181/181 [00:16<00:00, 10.72it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.51it/s]
                   all        936       1195      0.965      0.945      0.976
0.901

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    185/400      2.13G     0.4427     0.3727      1.004         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.55it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.44it/s]
                   all        936       1195      0.969      0.938      0.974
0.901

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    186/400      2.13G     0.4356     0.3707     0.9993         23        640:
100%|██████████| 181/181 [00:16<00:00, 10.65it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.69it/s]
                   all        936       1195      0.969      0.933      0.977
0.905

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    187/400      2.13G     0.4342     0.3681      1.007         14        640:
100%|██████████| 181/181 [00:19<00:00,  9.43it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.40it/s]
                   all        936       1195      0.966      0.937      0.976
0.905

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    188/400      2.13G     0.4415     0.3621      1.005         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.28it/s]
                   all        936       1195      0.974      0.931      0.978
0.904

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    189/400      2.27G     0.4445     0.3697      1.008         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.61it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.33it/s]
                   all        936       1195      0.969      0.936       0.98
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    190/400      2.13G     0.4317     0.3583     0.9971         19        640:
100%|██████████| 181/181 [00:16<00:00, 10.69it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.29it/s]
                   all        936       1195      0.979      0.926      0.978
0.906

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    191/400      2.13G     0.4404     0.3625      1.006         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.48it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.40it/s]
                   all        936       1195      0.976      0.934       0.98
0.907

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
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    192/400      2.13G      0.439     0.3637      1.004         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.62it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.32it/s]
                   all        936       1195      0.977      0.931       0.98
0.906

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    193/400      2.13G     0.4412     0.3643      1.007         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.43it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.31it/s]
                   all        936       1195      0.975      0.933      0.979
0.907

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    194/400      2.27G     0.4371     0.3676      1.006         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.57it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.37it/s]
                   all        936       1195      0.974      0.933      0.979
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    195/400      2.13G     0.4375     0.3562     0.9989         19        640:
100%|██████████| 181/181 [00:16<00:00, 10.67it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.42it/s]
                   all        936       1195      0.973      0.933      0.979
0.907

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    196/400      2.13G     0.4237     0.3613     0.9946         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.60it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  9.35it/s]
                   all        936       1195      0.966      0.938      0.979
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    197/400      2.13G     0.4345     0.3669      1.005         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.55it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.85it/s]
                   all        936       1195      0.969      0.938      0.979
0.907

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    198/400      2.13G     0.4255     0.3569     0.9915         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.39it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195      0.977       0.93      0.979
0.906

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    199/400      2.27G     0.4248     0.3551     0.9963         19        640:
100%|██████████| 181/181 [00:18<00:00,  9.93it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195      0.982      0.927      0.979
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
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    200/400      2.13G     0.4333      0.358          1         22        640:
100%|██████████| 181/181 [00:18<00:00,  9.58it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.29it/s]
                   all        936       1195       0.97      0.933       0.98
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    201/400      2.27G      0.433      0.353      1.002         19        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.46it/s]
                   all        936       1195      0.974      0.928      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    202/400      2.13G     0.4228     0.3573     0.9924         18        640:
100%|██████████| 181/181 [00:18<00:00,  9.98it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.34it/s]
                   all        936       1195      0.964      0.935      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    203/400      2.13G     0.4204     0.3535      0.996         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.39it/s]
                   all        936       1195       0.98      0.921      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    204/400      2.26G     0.4295     0.3524     0.9944         18        640:
100%|██████████| 181/181 [00:18<00:00,  9.87it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.71it/s]
                   all        936       1195      0.952      0.948      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    205/400      2.27G     0.4258     0.3531      1.001         13        640:
100%|██████████| 181/181 [00:20<00:00,  8.70it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.18it/s]
                   all        936       1195      0.965      0.938      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    206/400      2.26G     0.4197     0.3545     0.9944         22        640:
100%|██████████| 181/181 [00:19<00:00,  9.07it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  6.89it/s]
                   all        936       1195      0.974      0.932      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    207/400      2.26G     0.4343     0.3548          1         17        640:
100%|██████████| 181/181 [00:18<00:00,  9.57it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.43it/s]
                   all        936       1195      0.964      0.938      0.979
0.91
```

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      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    208/400      2.13G      0.427     0.3533     0.9916         24        640:
100%|██████████| 181/181 [00:18<00:00,  9.89it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.31it/s]
                   all        936       1195       0.97      0.933      0.979
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    209/400      2.26G     0.4262     0.3409     0.9941         24        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195      0.975      0.933      0.979
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    210/400      2.13G     0.4264     0.3605     0.9911         18        640:
100%|██████████| 181/181 [00:18<00:00,  9.99it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.13it/s]
                   all        936       1195      0.972      0.935      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    211/400      2.13G     0.4192     0.3424     0.9958         18        640:
100%|██████████| 181/181 [00:19<00:00,  9.38it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.80it/s]
                   all        936       1195      0.967       0.94      0.977
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    212/400      2.26G     0.4238     0.3467      0.998         16        640:
100%|██████████| 181/181 [00:18<00:00,  9.99it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.15it/s]
                   all        936       1195      0.963      0.949      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    213/400      2.26G     0.4218     0.3526     0.9963         25        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.19it/s]
                   all        936       1195      0.961      0.943      0.977
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    214/400      2.26G     0.4272     0.3487     0.9957         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.35it/s]
                   all        936       1195      0.962      0.943      0.977
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    215/400      2.13G     0.4221     0.3408     0.9918         18        640:
100%|██████████| 181/181 [00:18<00:00,  9.93it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.09it/s]
                   all        936       1195      0.968      0.936      0.977
0.91
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      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    216/400      2.26G     0.4186     0.3457     0.9911         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.17it/s]
                   all        936       1195      0.967      0.934      0.976
0.907

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    217/400      2.13G     0.4156     0.3394     0.9891         14        640:
100%|██████████| 181/181 [00:19<00:00,  9.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.83it/s]
                   all        936       1195      0.977      0.929      0.977
0.907

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    218/400      2.14G     0.4224     0.3503     0.9907         18        640:
100%|██████████| 181/181 [00:18<00:00,  9.87it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.37it/s]
                   all        936       1195      0.979      0.931      0.977
0.905

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    219/400      2.13G     0.4204     0.3422     0.9911         12        640:
100%|██████████| 181/181 [00:17<00:00, 10.07it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.28it/s]
                   all        936       1195      0.968      0.941      0.977
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    220/400      2.26G     0.4132     0.3412     0.9869         14        640:
100%|██████████| 181/181 [00:18<00:00,  9.94it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195      0.966      0.944      0.977
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    221/400      2.13G     0.4172     0.3417     0.9878         20        640:
100%|██████████| 181/181 [00:18<00:00,  9.99it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.17it/s]
                   all        936       1195       0.97      0.942      0.978
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    222/400      2.26G      0.409     0.3427     0.9847         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.07it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.36it/s]
                   all        936       1195      0.967      0.947      0.978
0.907

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    223/400      2.26G     0.4126     0.3432     0.9907         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.24it/s]
                   all        936       1195      0.963      0.948      0.977
0.908
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0.908
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    224/400      2.13G     0.4088      0.337     0.9839         27        640:
100%|██████████| 181/181 [00:18<00:00,  9.98it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195      0.964      0.946      0.978
0.906
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    225/400      2.13G      0.409     0.3377     0.9839         13        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.43it/s]
                   all        936       1195      0.963       0.95      0.977
0.907
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    226/400      2.13G     0.4182     0.3393     0.9883         16        640:
100%|██████████| 181/181 [00:18<00:00,  9.95it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.27it/s]
                   all        936       1195      0.964      0.949      0.978
0.908
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    227/400      2.13G     0.4089     0.3353     0.9829         19        640:
100%|██████████| 181/181 [00:18<00:00,  9.98it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.76it/s]
                   all        936       1195      0.967      0.947      0.978
0.909
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    228/400      2.13G     0.4063     0.3321     0.9851         17        640:
100%|██████████| 181/181 [00:18<00:00,  9.94it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.16it/s]
                   all        936       1195      0.965      0.948      0.979
0.909
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    229/400      2.26G      0.409     0.3328     0.9857         27        640:
100%|██████████| 181/181 [00:18<00:00,  9.65it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.10it/s]
                   all        936       1195      0.965       0.95      0.978
0.91
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    230/400      2.13G     0.4127     0.3399     0.9892         20        640:
100%|██████████| 181/181 [00:18<00:00,  9.69it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.37it/s]
                   all        936       1195      0.967      0.947      0.978
0.909
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    231/400      2.27G     0.4077       0.34     0.9871         17        640:
100%|██████████| 181/181 [00:19<00:00,  9.16it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.32it/s]
                   all        936       1195      0.966      0.948      0.977
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0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    232/400      2.26G     0.3993     0.3319     0.9854         25        640:
100%|██████████| 181/181 [00:19<00:00,  9.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.34it/s]
                   all        936       1195      0.969      0.947      0.976
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    233/400      2.27G      0.393     0.3276     0.9797         12        640:
100%|██████████| 181/181 [00:19<00:00,  9.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.33it/s]
                   all        936       1195      0.979      0.939      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    234/400      2.13G     0.4014     0.3289     0.9824         17        640:
100%|██████████| 181/181 [00:18<00:00,  9.82it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.29it/s]
                   all        936       1195      0.976      0.941      0.977
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    235/400      2.13G     0.4107     0.3318     0.9808         23        640:
100%|██████████| 181/181 [00:19<00:00,  9.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.66it/s]
                   all        936       1195      0.975      0.944      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    236/400      2.13G      0.407     0.3349     0.9875         14        640:
100%|██████████| 181/181 [00:18<00:00,  9.99it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.36it/s]
                   all        936       1195      0.974      0.941      0.977
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    237/400      2.13G     0.4071     0.3353     0.9836         20        640:
100%|██████████| 181/181 [00:18<00:00,  9.99it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.28it/s]
                   all        936       1195      0.976      0.939      0.977
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    238/400      2.13G     0.4048     0.3352     0.9802         11        640:
100%|██████████| 181/181 [00:17<00:00, 10.07it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.13it/s]
                   all        936       1195      0.972      0.941      0.977
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    239/400      2.13G     0.3987     0.3263      0.977         28        640:
100%|██████████| 181/181 [00:20<00:00,  9.03it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.45it/s]
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                   all        936       1195      0.982      0.934      0.977
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    240/400      2.13G     0.4004     0.3226     0.9837         15        640:
100%|██████████| 181/181 [00:20<00:00,  8.66it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.33it/s]
                   all        936       1195      0.967      0.944      0.977
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    241/400      2.13G      0.403      0.328     0.9778         12        640:
100%|██████████| 181/181 [00:19<00:00,  9.18it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.13it/s]
                   all        936       1195       0.98      0.933      0.977
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    242/400      2.27G     0.3975     0.3258     0.9796         16        640:
100%|██████████| 181/181 [00:18<00:00, 10.01it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.25it/s]
                   all        936       1195      0.976      0.937      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    243/400      2.13G     0.3944     0.3224     0.9756         19        640:
100%|██████████| 181/181 [00:19<00:00,  9.24it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.42it/s]
                   all        936       1195      0.972      0.937      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    244/400      2.26G     0.3961     0.3258     0.9775         21        640:
100%|██████████| 181/181 [00:19<00:00,  9.45it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.04it/s]
                   all        936       1195       0.97      0.936      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    245/400      2.26G     0.4009     0.3262     0.9888          9        640:
100%|██████████| 181/181 [00:19<00:00,  9.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.40it/s]
                   all        936       1195      0.979      0.927      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    246/400      2.13G     0.3987     0.3188     0.9755         25        640:
100%|██████████| 181/181 [00:18<00:00,  9.54it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.42it/s]
                   all        936       1195      0.966       0.94      0.978
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    247/400      2.13G      0.397      0.319     0.9813         15        640:
100%|██████████| 181/181 [00:19<00:00,  9.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  6.84it/s]
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                   all        936       1195      0.975      0.933      0.978
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    248/400      2.13G     0.4011     0.3193     0.9755         26        640:
100%|██████████| 181/181 [00:19<00:00,  9.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.30it/s]
                   all        936       1195      0.977       0.93      0.977
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    249/400      2.13G     0.3938     0.3187     0.9778         26        640:
100%|██████████| 181/181 [00:19<00:00,  9.19it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.42it/s]
                   all        936       1195      0.967       0.94      0.977
0.907

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    250/400      2.13G     0.3944     0.3266     0.9817         15        640:
100%|██████████| 181/181 [00:18<00:00,  9.81it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.39it/s]
                   all        936       1195      0.979      0.927      0.976
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    251/400      2.13G     0.4002     0.3279     0.9837         21        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.14it/s]
                   all        936       1195      0.976      0.934      0.977
0.907

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    252/400      2.13G     0.3929     0.3138     0.9798         22        640:
100%|██████████| 181/181 [00:19<00:00,  9.50it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.04it/s]
                   all        936       1195      0.975      0.936      0.977
0.907

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    253/400      2.13G     0.3937     0.3197     0.9795         16        640:
100%|██████████| 181/181 [00:20<00:00,  8.77it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.74it/s]
                   all        936       1195      0.969      0.939      0.977
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    254/400      2.26G     0.3976     0.3239      0.978         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.27it/s]
                   all        936       1195      0.975      0.935      0.977
0.908

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    255/400      2.13G     0.3916     0.3246     0.9748         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.20it/s]
                 Class     Images  Instances      Box(P          R      mAP50
```

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mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.54it/s]
                   all        936       1195      0.962      0.946      0.977
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    256/400      2.13G     0.3877     0.3155     0.9757         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.53it/s]
                   all        936       1195      0.963      0.947      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    257/400      2.26G      0.392      0.318     0.9735         24        640:
100%|██████████| 181/181 [00:19<00:00,  9.40it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  6.92it/s]
                   all        936       1195      0.964      0.945      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    258/400      2.13G     0.3847     0.3145     0.9684         18        640:
100%|██████████| 181/181 [00:20<00:00,  8.85it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.27it/s]
                   all        936       1195      0.964      0.945      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    259/400      2.13G     0.3879     0.3162     0.9784         19        640:
100%|██████████| 181/181 [00:18<00:00,  9.69it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.35it/s]
                   all        936       1195      0.961      0.946      0.979
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    260/400      2.13G     0.3882     0.3129     0.9783         18        640:
100%|██████████| 181/181 [00:19<00:00,  9.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  6.89it/s]
                   all        936       1195      0.958      0.948      0.979
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    261/400      2.13G     0.3871     0.3134      0.976         16        640:
100%|██████████| 181/181 [00:18<00:00,  9.58it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.41it/s]
                   all        936       1195      0.961      0.942      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    262/400      2.13G      0.386     0.3178     0.9739         15        640:
100%|██████████| 181/181 [00:20<00:00,  8.92it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.12it/s]
                   all        936       1195      0.962      0.944      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    263/400      2.13G       0.39     0.3167     0.9735         12        640:
100%|██████████| 181/181 [00:18<00:00,  9.71it/s]
                 Class     Images  Instances      Box(P          R      mAP50
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                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.36it/s]
                   all        936       1195       0.96      0.947      0.979
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    264/400      2.13G     0.3949     0.3141     0.9794         17        640:
100%|██████████| 181/181 [00:19<00:00,  9.42it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.38it/s]
                   all        936       1195      0.962      0.946      0.979
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    265/400      2.13G      0.386     0.3148     0.9699         18        640:
100%|██████████| 181/181 [00:19<00:00,  9.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.42it/s]
                   all        936       1195      0.961      0.947      0.979
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    266/400      2.26G     0.3869     0.3123     0.9714         24        640:
100%|██████████| 181/181 [00:19<00:00,  9.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.36it/s]
                   all        936       1195      0.963      0.947      0.979
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    267/400      2.13G     0.3811     0.3113      0.974         19        640:
100%|██████████| 181/181 [00:18<00:00,  9.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.46it/s]
                   all        936       1195      0.962      0.947       0.98
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    268/400      2.26G     0.3831     0.3135     0.9734         22        640:
100%|██████████| 181/181 [00:18<00:00,  9.75it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.41it/s]
                   all        936       1195      0.962      0.947       0.98
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    269/400      2.13G     0.3904     0.3156     0.9764         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.42it/s]
                   all        936       1195      0.962      0.946       0.98
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    270/400      2.26G     0.3824      0.311     0.9732         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.07it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.19it/s]
                   all        936       1195      0.961      0.947       0.98
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    271/400      2.14G     0.3868     0.3114     0.9769         19        640:
100%|██████████| 181/181 [00:18<00:00,  9.91it/s]
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                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.42it/s]
                   all        936       1195      0.961      0.948       0.98
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    272/400      2.26G     0.3826     0.3065     0.9682         13        640:
100%|██████████| 181/181 [00:20<00:00,  9.01it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.57it/s]
                   all        936       1195      0.958      0.949       0.98
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    273/400      2.13G     0.3872     0.3146     0.9726         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.35it/s]
                   all        936       1195      0.959      0.948      0.981
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    274/400      2.13G     0.3804     0.3126     0.9715         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.16it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.53it/s]
                   all        936       1195      0.975      0.933       0.98
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    275/400      2.13G     0.3737      0.301      0.965         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.16it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.55it/s]
                   all        936       1195      0.977      0.934       0.98
0.913

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    276/400      2.13G     0.3803     0.3077     0.9697         16        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.25it/s]
                   all        936       1195      0.976      0.933       0.98
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    277/400      2.27G     0.3804     0.3034     0.9729         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.13it/s]
                   all        936       1195      0.967      0.943      0.981
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    278/400      2.13G     0.3775     0.3018     0.9664         24        640:
100%|██████████| 181/181 [00:18<00:00, 10.03it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.89it/s]
                   all        936       1195      0.968      0.942       0.98
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    279/400      2.13G     0.3737     0.3018     0.9659         13        640:
100%|██████████| 181/181 [00:18<00:00, 10.02it/s]
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100%|██████████| 181/181 [00:18<00:00, 10.02it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.51it/s]
                   all        936       1195      0.968      0.942      0.979
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    280/400      2.13G     0.3775     0.3011     0.9682         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.09it/s]
                   all        936       1195      0.969      0.942       0.98
0.913

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    281/400      2.13G     0.3721     0.2988     0.9659         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.35it/s]
                   all        936       1195      0.969      0.941      0.979
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    282/400      2.27G     0.3772     0.3044     0.9715         15        640:
100%|██████████| 181/181 [00:18<00:00,  9.79it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.41it/s]
                   all        936       1195      0.971       0.94      0.979
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    283/400      2.27G     0.3739     0.3041     0.9684         17        640:
100%|██████████| 181/181 [00:18<00:00,  9.73it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.93it/s]
                   all        936       1195       0.97      0.942      0.979
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    284/400      2.13G     0.3738     0.2953     0.9695         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.42it/s]
                   all        936       1195      0.968      0.943      0.979
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    285/400      2.13G       0.37     0.3014     0.9662         16        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.39it/s]
                   all        936       1195      0.964      0.942      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    286/400      2.13G      0.371     0.2917     0.9624         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.14it/s]
                   all        936       1195      0.977       0.93      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    287/400      2.13G     0.3647     0.2913       0.96         20        640:
```

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100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.36it/s]
                   all        936       1195      0.975       0.93      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    288/400      2.13G     0.3647     0.2924     0.9608         25        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.46it/s]
                   all        936       1195      0.976       0.93      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    289/400      2.13G     0.3677     0.2967     0.9635         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.18it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.91it/s]
                   all        936       1195      0.976       0.93      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    290/400      2.13G      0.374     0.2987     0.9637         20        640:
100%|██████████| 181/181 [00:18<00:00,  9.83it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.49it/s]
                   all        936       1195      0.977       0.93      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    291/400      2.13G     0.3597     0.2904     0.9639         14        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.40it/s]
                   all        936       1195       0.98      0.927      0.979
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    292/400      2.13G     0.3698     0.2971     0.9661         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.17it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.10it/s]
                   all        936       1195      0.982      0.925      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    293/400      2.13G     0.3684     0.3023     0.9665         23        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.30it/s]
                   all        936       1195       0.98      0.925      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    294/400      2.13G     0.3712     0.2994     0.9635         31        640:
100%|██████████| 181/181 [00:17<00:00, 10.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.26it/s]
                   all        936       1195      0.981      0.925      0.979
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
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    295/400      2.26G     0.3711     0.2983     0.9652          28        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.39it/s]
                   all        936       1195      0.981      0.926      0.979
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    296/400      2.13G     0.3692     0.2944     0.9626         21        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.46it/s]
                   all        936       1195      0.981      0.927      0.979
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    297/400      2.13G     0.3616     0.2873      0.963         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.23it/s]
                   all        936       1195       0.98      0.926      0.979
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    298/400      2.13G     0.3627     0.2911     0.9604         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.45it/s]
                   all        936       1195       0.98      0.926      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    299/400      2.13G     0.3664      0.288     0.9646         26        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.44it/s]
                   all        936       1195      0.979      0.927      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    300/400      2.26G     0.3681     0.2901     0.9597         27        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.33it/s]
                   all        936       1195      0.979      0.928      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    301/400      2.13G     0.3606     0.2907      0.961         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.28it/s]
                   all        936       1195      0.977      0.928      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    302/400      2.13G     0.3672     0.2935     0.9631         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.43it/s]
                   all        936       1195      0.977      0.929      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
```

```
    303/400      2.13G     0.3645     0.2891     0.9629         11        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.42it/s]
                   all        936       1195      0.977       0.93      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    304/400      2.26G     0.3629     0.2939     0.9593         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.45it/s]
                   all        936       1195      0.976       0.93      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    305/400      2.13G     0.3625     0.2889     0.9597         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.55it/s]
                   all        936       1195      0.977       0.93      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    306/400      2.13G     0.3593     0.2823     0.9628         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.29it/s]
                   all        936       1195      0.977      0.931      0.978
0.909

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    307/400      2.13G     0.3611       0.29     0.9624         15        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.34it/s]
                   all        936       1195      0.978       0.93      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    308/400      2.26G     0.3565     0.2862     0.9623         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195      0.978      0.929      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    309/400      2.13G     0.3536     0.2826     0.9561         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.07it/s]
                   all        936       1195      0.976      0.929      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    310/400      2.13G     0.3594     0.2841     0.9606         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.21it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.29it/s]
                   all        936       1195      0.977      0.929      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
```

```
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    311/400      2.26G     0.3522     0.2836     0.9553         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.07it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.49it/s]
                   all        936       1195      0.978      0.928      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    312/400      2.13G     0.3592     0.2883       0.96         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.17it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.21it/s]
                   all        936       1195      0.978      0.928      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    313/400      2.13G     0.3537       0.28      0.954         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.21it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.91it/s]
                   all        936       1195      0.977      0.928      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    314/400      2.13G     0.3457     0.2766     0.9533         17        640:
100%|██████████| 181/181 [00:18<00:00,  9.84it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.97it/s]
                   all        936       1195      0.964       0.94      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    315/400      2.13G      0.354     0.2761      0.955         13        640:
100%|██████████| 181/181 [00:18<00:00,  9.91it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.09it/s]
                   all        936       1195      0.968      0.936      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    316/400      2.26G     0.3552     0.2853     0.9564         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.27it/s]
                   all        936       1195      0.969      0.936      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    317/400      2.26G     0.3539      0.282     0.9516         27        640:
100%|██████████| 181/181 [00:18<00:00,  9.99it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.29it/s]
                   all        936       1195      0.973      0.933      0.979
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    318/400      2.13G     0.3541     0.2816     0.9603         15        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.11it/s]
                   all        936       1195      0.974      0.933      0.978
0.911
```

```
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    319/400      2.13G     0.3448     0.2763     0.9528         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.19it/s]
                   all        936       1195      0.973      0.933      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    320/400      2.26G     0.3553     0.2844     0.9571         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.31it/s]
                   all        936       1195      0.972      0.934      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    321/400      2.27G      0.353     0.2813     0.9592         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.89it/s]
                   all        936       1195      0.977      0.927      0.979
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    322/400      2.13G     0.3454     0.2786     0.9527         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.10it/s]
                   all        936       1195      0.977      0.927      0.979
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    323/400      2.13G      0.346     0.2706     0.9525         23        640:
100%|██████████| 181/181 [00:18<00:00, 10.01it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.15it/s]
                   all        936       1195      0.963      0.943      0.979
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    324/400      2.26G     0.3468     0.2741     0.9462         13        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.28it/s]
                   all        936       1195      0.976      0.929      0.979
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    325/400      2.27G     0.3478     0.2751     0.9518         21        640:
100%|██████████| 181/181 [00:18<00:00, 10.03it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.25it/s]
                   all        936       1195      0.976       0.93      0.979
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    326/400      2.13G     0.3442     0.2756     0.9549         23        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.99it/s]
                   all        936       1195      0.977       0.93      0.979
0.912
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      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    327/400      2.27G      0.347     0.2747     0.9551         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.31it/s]
                   all        936       1195      0.973      0.933      0.979
0.912
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    328/400      2.13G     0.3479     0.2818     0.9558         18        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.40it/s]
                   all        936       1195      0.974      0.933      0.978
0.912
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    329/400      2.13G     0.3469     0.2787     0.9522         24        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.30it/s]
                   all        936       1195      0.972      0.933      0.978
0.912
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    330/400      2.13G     0.3432     0.2756     0.9526         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.78it/s]
                   all        936       1195      0.971      0.934      0.978
0.913
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    331/400      2.13G     0.3393     0.2687     0.9483         22        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.26it/s]
                   all        936       1195      0.971      0.934      0.978
0.913
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    332/400      2.13G     0.3464     0.2801     0.9572         14        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.41it/s]
                   all        936       1195      0.971      0.932      0.978
0.912
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    333/400      2.13G     0.3374     0.2668     0.9518         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.89it/s]
                   all        936       1195      0.977      0.928      0.979
0.912
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    334/400      2.26G     0.3402     0.2696     0.9499         26        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.22it/s]
                   all        936       1195      0.972      0.932      0.979
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0.912
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    335/400      2.13G     0.3432     0.2674     0.9539         20        640:
100%|██████████| 181/181 [00:18<00:00, 10.00it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.45it/s]
                   all        936       1195      0.978      0.928      0.979
0.913
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    336/400      2.13G     0.3453     0.2747     0.9504         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.99it/s]
                   all        936       1195      0.978      0.928      0.978
0.912
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    337/400      2.26G     0.3379     0.2731     0.9508         26        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.26it/s]
                   all        936       1195      0.972      0.933      0.978
0.913
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    338/400      2.13G     0.3422     0.2682     0.9501         23        640:
100%|██████████| 181/181 [00:18<00:00, 10.01it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.13it/s]
                   all        936       1195      0.971      0.934      0.978
0.913
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    339/400      2.26G     0.3364     0.2716     0.9479         16        640:
100%|██████████| 181/181 [00:17<00:00, 10.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.08it/s]
                   all        936       1195      0.978      0.927      0.979
0.913
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    340/400      2.13G     0.3275     0.2613     0.9448         21        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.25it/s]
                   all        936       1195      0.977      0.927      0.978
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    341/400      2.13G     0.3347     0.2679     0.9442         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.12it/s]
                   all        936       1195      0.975      0.929      0.978
0.912
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    342/400      2.13G     0.3431     0.2734     0.9515         27        640:
100%|██████████| 181/181 [00:17<00:00, 10.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.24it/s]
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                   all        936       1195      0.973      0.931      0.977
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    343/400      2.13G      0.338     0.2698     0.9464         15        640:
100%|██████████| 181/181 [00:17<00:00, 10.14it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.30it/s]
                   all        936       1195      0.976      0.927      0.978
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    344/400      2.13G     0.3293     0.2612     0.9444         24        640:
100%|██████████| 181/181 [00:18<00:00, 10.01it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.16it/s]
                   all        936       1195      0.976      0.928      0.977
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    345/400      2.13G     0.3294     0.2647     0.9474         26        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.22it/s]
                   all        936       1195      0.972      0.931      0.977
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    346/400      2.13G     0.3298     0.2635     0.9428         29        640:
100%|██████████| 181/181 [00:17<00:00, 10.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.31it/s]
                   all        936       1195      0.972      0.932      0.978
0.912

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    347/400      2.13G     0.3324     0.2632     0.9448         24        640:
100%|██████████| 181/181 [00:18<00:00,  9.96it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.19it/s]
                   all        936       1195       0.97      0.933      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    348/400      2.13G     0.3338     0.2663     0.9479         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.29it/s]
                   all        936       1195      0.977      0.928      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    349/400      2.13G     0.3372     0.2698     0.9537         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.17it/s]
                   all        936       1195       0.97      0.934      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    350/400      2.26G     0.3316     0.2645     0.9465         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.19it/s]
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mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.19it/s]
                   all        936       1195      0.971      0.933      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    351/400      2.13G     0.3213     0.2538     0.9393         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.16it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.21it/s]
                   all        936       1195      0.976       0.93      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    352/400      2.13G     0.3374     0.2611     0.9532         15        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.25it/s]
                   all        936       1195      0.976       0.93      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    353/400      2.13G     0.3326     0.2606     0.9465         22        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.28it/s]
                   all        936       1195      0.975      0.931      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    354/400      2.13G     0.3309     0.2633      0.948         15        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.25it/s]
                   all        936       1195      0.974      0.934      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    355/400      2.13G     0.3379     0.2634     0.9529         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.14it/s]
                   all        936       1195      0.974      0.934      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    356/400      2.13G      0.323      0.258     0.9377         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.13it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.24it/s]
                   all        936       1195      0.975       0.93      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    357/400      2.27G     0.3283     0.2633     0.9457         12        640:
100%|██████████| 181/181 [00:17<00:00, 10.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.22it/s]
                   all        936       1195      0.975      0.929      0.977
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    358/400      2.13G     0.3308     0.2634     0.9415         21        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
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mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.29it/s]
                   all        936       1195      0.974      0.929      0.977
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    359/400      2.13G     0.3283     0.2607     0.9436         21        640:
100%|██████████| 181/181 [00:18<00:00, 10.01it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.18it/s]
                   all        936       1195      0.974       0.93      0.977
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    360/400      2.13G     0.3222     0.2557     0.9436         26        640:
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.19it/s]
                   all        936       1195      0.974       0.93      0.977
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    361/400      2.13G     0.3165     0.2473     0.9391         24        640:
100%|██████████| 181/181 [00:17<00:00, 10.06it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.23it/s]
                   all        936       1195      0.974       0.93      0.977
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    362/400      2.13G      0.322     0.2578     0.9459         15        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.12it/s]
                   all        936       1195      0.975      0.928      0.977
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    363/400      2.13G     0.3233     0.2558     0.9417         18        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.16it/s]
                   all        936       1195      0.975      0.927      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    364/400      2.13G     0.3156     0.2492     0.9393         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.12it/s]
                   all        936       1195      0.975      0.927      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    365/400      2.13G     0.3192     0.2505     0.9406         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.98it/s]
                   all        936       1195      0.975      0.927      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    366/400      2.13G     0.3254     0.2555     0.9405         25        640:
100%|██████████| 181/181 [00:17<00:00, 10.10it/s]
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                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.18it/s]
                   all        936       1195      0.976      0.928      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    367/400      2.13G     0.3217     0.2564     0.9405         18        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.26it/s]
                   all        936       1195      0.976      0.928      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    368/400      2.26G     0.3174     0.2521     0.9416         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.90it/s]
                   all        936       1195      0.976      0.928      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    369/400      2.13G     0.3213     0.2541     0.9424         21        640:
100%|██████████| 181/181 [00:18<00:00, 10.03it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.72it/s]
                   all        936       1195      0.976      0.928      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    370/400      2.13G     0.3133     0.2489     0.9365         28        640:
100%|██████████| 181/181 [00:19<00:00,  9.15it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.19it/s]
                   all        936       1195      0.975      0.928      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    371/400      2.13G      0.318     0.2517     0.9406         17        640:
100%|██████████| 181/181 [00:18<00:00,  9.82it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.10it/s]
                   all        936       1195       0.98      0.924      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    372/400      2.26G       0.32     0.2536     0.9423         17        640:
100%|██████████| 181/181 [00:19<00:00,  9.38it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.06it/s]
                   all        936       1195      0.979      0.925      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    373/400      2.13G     0.3171     0.2468     0.9372         28        640:
100%|██████████| 181/181 [00:18<00:00,  9.98it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.19it/s]
                   all        936       1195      0.977      0.927      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    374/400      2.13G     0.3198     0.2564     0.9419         14        640:
100%|██████████| 181/181 [00:18<00:00,  9.98it/s]
```

```
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.30it/s]
                   all        936       1195      0.977      0.928      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    375/400      2.13G     0.3132     0.2471     0.9356         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.19it/s]
                   all        936       1195      0.976      0.927      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    376/400      2.26G     0.3155     0.2491     0.9398         24        640:
100%|██████████| 181/181 [00:18<00:00, 10.00it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.27it/s]
                   all        936       1195      0.976      0.928      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    377/400      2.26G     0.3147     0.2489     0.9374         19        640:
100%|██████████| 181/181 [00:18<00:00,  9.88it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  7.28it/s]
                   all        936       1195      0.976      0.927      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    378/400      2.27G     0.3147     0.2454     0.9385         18        640:
100%|██████████| 181/181 [00:18<00:00, 10.03it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.22it/s]
                   all        936       1195      0.977      0.927      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    379/400      2.13G      0.314     0.2458     0.9348         18        640:
100%|██████████| 181/181 [00:18<00:00, 10.05it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.99it/s]
                   all        936       1195      0.977      0.927      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    380/400      2.13G     0.3143      0.245     0.9384         20        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.28it/s]
                   all        936       1195      0.977      0.927      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    381/400      2.27G     0.3136     0.2429     0.9379         18        640:
100%|██████████| 181/181 [00:18<00:00, 10.00it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.35it/s]
                   all        936       1195      0.976      0.926      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    382/400      2.13G     0.3091     0.2437     0.9326         20        640:
```

```
100%|██████████| 181/181 [00:17<00:00, 10.09it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.29it/s]
                   all        936       1195      0.977      0.926      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    383/400      2.27G     0.3137     0.2449      0.939         15        640:
100%|██████████| 181/181 [00:18<00:00, 10.04it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.38it/s]
                   all        936       1195      0.977      0.926      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    384/400      2.13G     0.3085     0.2426     0.9334         17        640:
100%|██████████| 181/181 [00:17<00:00, 10.11it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.23it/s]
                   all        936       1195      0.978      0.925      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    385/400      2.13G      0.311     0.2455     0.9341         25        640:
100%|██████████| 181/181 [00:18<00:00,  9.93it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.12it/s]
                   all        936       1195      0.978      0.925      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    386/400      2.27G      0.311     0.2421     0.9397         22        640:
100%|██████████| 181/181 [00:18<00:00, 10.01it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.24it/s]
                   all        936       1195      0.977      0.926      0.978
0.911

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    387/400      2.13G     0.3063     0.2433     0.9381         19        640:
100%|██████████| 181/181 [00:17<00:00, 10.08it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.36it/s]
                   all        936       1195      0.977      0.926      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    388/400      2.26G     0.3113     0.2466     0.9378         17        640:
100%|██████████| 181/181 [00:18<00:00,  9.97it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.29it/s]
                   all        936       1195      0.977      0.926      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    389/400      2.13G     0.3101     0.2391      0.935         20        640:
100%|██████████| 181/181 [00:18<00:00, 10.03it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.19it/s]
                   all        936       1195      0.977      0.926      0.978
0.91

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    390/400      2.13G     0.3029     0.2388     0.9325         13        640:
```

```
100%|██████████| 181/181 [00:17<00:00, 10.12it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.14it/s]
                   all        936       1195      0.976      0.926      0.978
0.91
Closing dataloader mosaic

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    391/400      2.26G     0.2539     0.2009     0.8776          6        640:
100%|██████████| 181/181 [00:17<00:00, 10.25it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.28it/s]
                   all        936       1195      0.977      0.926      0.978
0.91
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    392/400      2.26G     0.2406     0.1818     0.8705         15        640:
100%|██████████| 181/181 [00:17<00:00, 10.55it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195      0.977      0.926      0.978
0.91
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    393/400      2.13G     0.2366     0.1775     0.8688          8        640:
100%|██████████| 181/181 [00:17<00:00, 10.49it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.33it/s]
                   all        936       1195      0.976      0.928      0.978
0.911
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    394/400      2.13G     0.2351     0.1799     0.8773          9        640:
100%|██████████| 181/181 [00:17<00:00, 10.46it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.32it/s]
                   all        936       1195      0.976      0.926      0.977
0.91
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    395/400      2.13G     0.2319     0.1776     0.8694          6        640:
100%|██████████| 181/181 [00:17<00:00, 10.48it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.18it/s]
                   all        936       1195      0.976      0.926      0.978
0.91
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    396/400      2.13G       0.23     0.1717     0.8679          9        640:
100%|██████████| 181/181 [00:17<00:00, 10.59it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.38it/s]
                   all        936       1195      0.977      0.925      0.978
0.91
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    397/400      2.13G     0.2305     0.1718     0.8707         11        640:
100%|██████████| 181/181 [00:17<00:00, 10.48it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  7.95it/s]
                   all        936       1195      0.976      0.926      0.978
0.91
```

```
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    398/400      2.13G     0.2234     0.1702     0.8656         11        640:
100%|██████████| 181/181 [00:17<00:00, 10.49it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.34it/s]
                   all        936       1195      0.976      0.926      0.977
0.91
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    399/400      2.13G     0.2262     0.1702     0.8681          7        640:
100%|██████████| 181/181 [00:17<00:00, 10.43it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.20it/s]
                   all        936       1195      0.976      0.926      0.977
0.911
      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    400/400      2.13G     0.2252      0.169     0.8658          7        640:
100%|██████████| 181/181 [00:17<00:00, 10.53it/s]
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:03<00:00,  8.29it/s]
                   all        936       1195      0.975      0.926      0.977
0.91

400 epochs completed in 2.447 hours.
Optimizer stripped from runs\detect\train3\weights\last.pt, 6.3MB
Optimizer stripped from runs\detect\train3\weights\best.pt, 6.3MB

Validating runs\detect\train3\weights\best.pt...
Ultralytics YOLOv8.2.100  Python-3.9.19 torch-2.0.0+cu117 CUDA:0 (NVIDIA GeForc
e RTX 3070 Laptop GPU, 8192MiB)
Model summary (fused): 168 layers, 3,006,818 parameters, 0 gradients, 8.1 GFLOP
s
                 Class     Images  Instances      Box(P          R      mAP50
mAP50-95): 100%|██████████| 30/30 [00:04<00:00,  6.65it/s]
                   all        936       1195      0.971      0.934      0.979
0.912
                   bus        198        230      0.967      0.983      0.994
0.951
                   car        182        201      0.957       0.91      0.962
0.935
             motorbike        165        216       0.96      0.894      0.967
0.778
            threewheel        167        227      0.991      0.932      0.982
0.93
                 truck        123        151      0.986      0.929      0.984
0.915
                   van        157        170      0.966      0.953      0.983
0.965
Speed: 0.2ms preprocess, 1.0ms inference, 0.0ms loss, 0.8ms postprocess per ima
ge
Results saved to runs\detect\train3
```

Out[4]:

```
ultralytics.utils.metrics.DetMetrics object with attributes:

ap_class_index: array([0, 1, 2, 3, 4, 5])
box: ultralytics.utils.metrics.Metric object
confusion_matrix: <ultralytics.utils.metrics.ConfusionMatrix object at 0x0000
01F630968BB0>
curves: ['Precision-Recall(B)', 'F1-Confidence(B)', 'Precision-Confidence
(B)', 'Recall-Confidence(B)']
```

```
curves_results: [[array([          0,    0.001001,    0.002002,    0.003003,
0.004004,    0.005005,    0.006006,    0.007007,    0.008008,    0.009009,
0.01001,    0.011011,    0.012012,    0.013013,    0.014014,    0.015015,
0.016016,    0.017017,    0.018018,    0.019019,     0.02002,    0.021021,
0.022022,    0.023023,
          0.024024,    0.025025,    0.026026,    0.027027,    0.028028,    0.
029029,     0.03003,    0.031031,    0.032032,    0.033033,    0.034034,
0.035035,    0.036036,    0.037037,    0.038038,    0.039039,     0.04004,
0.041041,    0.042042,    0.043043,    0.044044,    0.045045,    0.046046,
0.047047,
          0.048048,    0.049049,     0.05005,    0.051051,    0.052052,    0.
053053,    0.054054,    0.055055,    0.056056,    0.057057,    0.058058,
0.059059,     0.06006,    0.061061,    0.062062,    0.063063,    0.064064,
0.065065,    0.066066,    0.067067,    0.068068,    0.069069,     0.07007,
0.071071,
          0.072072,    0.073073,    0.074074,    0.075075,    0.076076,    0.
077077,    0.078078,    0.079079,     0.08008,    0.081081,    0.082082,
0.083083,    0.084084,    0.085085,    0.086086,    0.087087,    0.088088,
0.089089,     0.09009,    0.091091,    0.092092,    0.093093,    0.094094,
0.095095,
          0.096096,    0.097097,    0.098098,    0.099099,      0.1001,
0.1011,      0.1021,      0.1031,      0.1041,     0.10511,     0.10611,
0.10711,     0.10811,     0.10911,     0.11011,     0.11111,     0.11211,
0.11311,     0.11411,     0.11512,     0.11612,     0.11712,     0.11812,
0.11912,
           0.12012,     0.12112,     0.12212,     0.12312,     0.12412,
0.12513,     0.12613,     0.12713,     0.12813,     0.12913,     0.13013,
0.13113,     0.13213,     0.13313,     0.13413,     0.13514,     0.13614,
0.13714,     0.13814,     0.13914,     0.14014,     0.14114,     0.14214,
0.14314,
           0.14414,     0.14515,     0.14615,     0.14715,     0.14815,
0.14915,     0.15015,     0.15115,     0.15215,     0.15315,     0.15415,
0.15516,     0.15616,     0.15716,     0.15816,     0.15916,     0.16016,
0.16116,     0.16216,     0.16316,     0.16416,     0.16517,     0.16617,
0.16717,
           0.16817,     0.16917,     0.17017,     0.17117,     0.17217,
0.17317,     0.17417,     0.17518,     0.17618,     0.17718,     0.17818,
0.17918,     0.18018,     0.18118,     0.18218,     0.18318,     0.18418,
0.18519,     0.18619,     0.18719,     0.18819,     0.18919,     0.19019,
0.19119,
           0.19219,     0.19319,     0.19419,      0.1952,      0.1962,
0.1972,      0.1982,      0.1992,      0.2002,      0.2012,      0.2022,
0.2032,      0.2042,     0.20521,     0.20621,     0.20721,     0.20821,
0.20921,     0.21021,     0.21121,     0.21221,     0.21321,     0.21421,
0.21522,
           0.21622,     0.21722,     0.21822,     0.21922,     0.22022,
0.22122,     0.22222,     0.22322,     0.22422,     0.22523,     0.22623,
0.22723,     0.22823,     0.22923,     0.23023,     0.23123,     0.23223,
0.23323,     0.23423,     0.23524,     0.23624,     0.23724,     0.23824,
0.23924,
           0.24024,     0.24124,     0.24224,     0.24324,     0.24424,
0.24525,     0.24625,     0.24725,     0.24825,     0.24925,     0.25025,
0.25125,     0.25225,     0.25325,     0.25425,     0.25526,     0.25626,
0.25726,     0.25826,     0.25926,     0.26026,     0.26126,     0.26226,
0.26326,
           0.26426,     0.26527,     0.26627,     0.26727,     0.26827,
0.26927,     0.27027,     0.27127,     0.27227,     0.27327,     0.27427,
0.27528,     0.27628,     0.27728,     0.27828,     0.27928,     0.28028,
0.28128,     0.28228,     0.28328,     0.28428,     0.28529,     0.28629,
0.28729,
           0.28829,     0.28929,     0.29029,     0.29129,     0.29229,
```

```
0.29329,    0.29429,     0.2953,     0.2963,     0.2973,     0.2983,
0.2993,     0.3003,     0.3013,     0.3023,     0.3033,     0.3043,
0.30531,    0.30631,    0.30731,    0.30831,    0.30931,    0.31031,
0.31131,
          0.31231,    0.31331,    0.31431,    0.31532,    0.31632,
0.31732,    0.31832,    0.31932,    0.32032,    0.32132,    0.32232,
0.32332,    0.32432,    0.32533,    0.32633,    0.32733,    0.32833,
0.32933,    0.33033,    0.33133,    0.33233,    0.33333,    0.33433,
0.33534,
          0.33634,    0.33734,    0.33834,    0.33934,    0.34034,
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