

## ✓ Importing the Required Libraries

```
import os

import glob

from IPython.display import Image, display

from IPython import display

display.clear_output()
```

## ✓ In the First Step, We need to check whether we have access to the GPU or not

```
!nvidia-smi
```

```
Mon Dec  9 09:12:20 2024
+-----+
| NVIDIA-SMI 535.104.05      Driver Version: 535.104.05    CUDA Version: 12.2 |
+-----+
| GPU  Name        Persistence-M | Bus-Id     Disp.A  | Volatile Uncorr. ECC | | | |
| Fan  Temp     Perf  Pwr:Usage/Cap | Memory-Usage | GPU-Util  Compute M. |
|          |          |          |             |          |          MIG M. |
+-----+
|  0  Tesla T4           Off  | 00000000:00:04.0 Off |          0 | | | |
| N/A   39C   P8          9W /  70W |      3MiB / 15360MiB |     0%      Default |
|          |          |          |             |          |          N/A |
+-----+
+-----+
| Processes:                               GPU Memory |
|  GPU  GI  CI      PID  Type  Process name        Usage  |
|    ID  ID
+-----+
|  No running processes found
+-----+
```

```
HOME = os.getcwd()
```

```
print(HOME)
```

```
/content
```

## ✓ Installing Ultralytics using Pip Install

```
!pip install ultralytics
```

```
Requirement already satisfied: ultralytics in /usr/local/lib/python3.10/dist-packages (8.3.48)
Requirement already satisfied: numpy>=1.23.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (1.26.4)
Requirement already satisfied: matplotlib>=3.3.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (3.8.0)
Requirement already satisfied: opencv-python>=4.6.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (4.10.0.84)
Requirement already satisfied: pillow>=7.1.2 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (11.0.0)
Requirement already satisfied: pyyaml>=5.3.1 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (6.0.2)
Requirement already satisfied: requests>=2.23.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (2.32.3)
Requirement already satisfied: scipy>=1.4.1 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (1.13.1)
Requirement already satisfied: torch>=1.8.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (2.5.1+cu121)
Requirement already satisfied: torchvision>=0.9.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (0.20.1+cu121)
Requirement already satisfied: tqdm>=4.64.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (4.66.6)
Requirement already satisfied: psutil in /usr/local/lib/python3.10/dist-packages (from ultralytics) (5.9.5)
Requirement already satisfied: py-cpuinfo in /usr/local/lib/python3.10/dist-packages (from ultralytics) (9.0.0)
Requirement already satisfied: pandas>=1.1.4 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (2.2.2)
Requirement already satisfied: seaborn>=0.11.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (0.13.2)
Requirement already satisfied: ultralytics-thop>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from ultralytics) (2.0.13)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (1.3.1)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (0.12.1)
```

```
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (4.55)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (1.4.7)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (24.2)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (3.2.0)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.3.0->ultralytics) (2.)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.1.4->ultralytics) (2024.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.1.4->ultralytics) (2024.2)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultralytics)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultralytics) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultralytics) (2.2.3)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests>=2.23.0->ultralytics) (2024)
Requirement already satisfied: filelock in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (3.16.1)
Requirement already satisfied: typing-extensions>=4.8.0 in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (4.1)
Requirement already satisfied: networkx in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (3.4.2)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (3.1.4)
Requirement already satisfied: fsspec in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (2024.10.0)
Requirement already satisfied: sympy==1.13.1 in /usr/local/lib/python3.10/dist-packages (from torch>=1.8.0->ultralytics) (1.13.1)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in /usr/local/lib/python3.10/dist-packages (from sympy==1.13.1->torch>=1.8.0->ultralyt)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7->matplotlib>=3.3.0->ultral
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.10/dist-packages (from jinja2>torch>=1.8.0->ultralytics) (3.0.
```

## ✓ Checking whether YOLOv8 is Installed and its working Fine

```
import ultralytics

ultralytics.checks()

 Ultralytics 8.3.48 🎉 Python-3.10.12 torch-2.5.1+cu121 CUDA:0 (Tesla T4, 15102MiB)
Setup complete ✅ (2 CPUs, 12.7 GB RAM, 32.7/112.6 GB disk)
```

## ✓ Importing the American Sign Language Alphabets Dataset from Roboflow

---

```
!pip install roboflow

from roboflow import Roboflow
rf = Roboflow(api_key="NvtepuP2r2Hu4ceJjJV")
project = rf.workspace("david-lee-d0rhs").project("american-sign-language-letters")
version = project.version(1)
dataset = version.download("yolov5")

 Requirement already satisfied: roboflow in /usr/local/lib/python3.10/dist-packages (1.1.49)
Requirement already satisfied: certifi in /usr/local/lib/python3.10/dist-packages (from roboflow) (2024.8.30)
Requirement already satisfied: idna==3.7 in /usr/local/lib/python3.10/dist-packages (from roboflow) (3.7)
Requirement already satisfied: cycler in /usr/local/lib/python3.10/dist-packages (from roboflow) (0.12.1)
Requirement already satisfied: kiwisolver>=1.3.1 in /usr/local/lib/python3.10/dist-packages (from roboflow) (1.4.7)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-packages (from roboflow) (3.8.0)
Requirement already satisfied: numpy>=1.18.5 in /usr/local/lib/python3.10/dist-packages (from roboflow) (1.126.4)
Requirement already satisfied: opencv-python-headless==4.10.0.84 in /usr/local/lib/python3.10/dist-packages (from roboflow) (4.10.0.84)
Requirement already satisfied: Pillow>=7.1.2 in /usr/local/lib/python3.10/dist-packages (from roboflow) (11.0.0)
Requirement already satisfied: python-dateutil in /usr/local/lib/python3.10/dist-packages (from roboflow) (2.8.2)
Requirement already satisfied: python-dotenv in /usr/local/lib/python3.10/dist-packages (from roboflow) (1.0.1)
Requirement already satisfied: requests in /usr/local/lib/python3.10/dist-packages (from roboflow) (2.32.3)
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-packages (from roboflow) (1.16.0)
Requirement already satisfied: urllib3>=1.26.6 in /usr/local/lib/python3.10/dist-packages (from roboflow) (2.2.3)
Requirement already satisfied: tqdm>=4.41.0 in /usr/local/lib/python3.10/dist-packages (from roboflow) (4.66.6)
Requirement already satisfied: PyYAML>=5.3.1 in /usr/local/lib/python3.10/dist-packages (from roboflow) (6.0.2)
Requirement already satisfied: requests-toolbelt in /usr/local/lib/python3.10/dist-packages (from roboflow) (1.0.0)
Requirement already satisfied: filetype in /usr/local/lib/python3.10/dist-packages (from roboflow) (1.2.0)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib->roboflow) (1.3.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib->roboflow) (4.55.1)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib->roboflow) (24.2)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib->roboflow) (3.2.0)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests->roboflow) (3.4.0)
loading Roboflow workspace...
loading Roboflow project...
```

## ✓ Train the YOLOv8 Model on the Custom Dataset

```
%cd {HOME}
```

```
↳ /content
```

```
%cd {dataset.location}
```

```
↳ /content/American-Sign-Language-Letters-1
```

```
%cd {HOME}
```

```
!yolo task=detect mode=train model=yolov8l.pt data={dataset.location}/data.yaml epochs=50 imgsz=800
```

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
47/50	15.6G	0.3663	0.2154	1.007	8	800: 100% 95/95 [01:54<00:00, 1.20s/it] mAP50 mAP50-95): 100% 5/5 [00:04<00:00, 1.18it/s]
	Class	Images	Instances	Box(P R		
	all	144	144	0.915	0.881	0.944 0.778
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
48/50	15.3G	0.3588	0.2078	0.9901	8	800: 100% 95/95 [01:54<00:00, 1.21s/it] mAP50 mAP50-95): 100% 5/5 [00:04<00:00, 1.09it/s]
	Class	Images	Instances	Box(P R		
	all	144	144	0.922	0.881	0.944 0.787
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
49/50	15.4G	0.3524	0.1976	0.9849	8	800: 100% 95/95 [01:54<00:00, 1.20s/it] mAP50 mAP50-95): 100% 5/5 [00:04<00:00, 1.16it/s]
	Class	Images	Instances	Box(P R		
	all	144	144	0.923	0.881	0.937 0.771
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
50/50	15.4G	0.3453	0.1945	0.9767	8	800: 100% 95/95 [01:54<00:00, 1.20s/it] mAP50 mAP50-95): 100% 5/5 [00:04<00:00, 1.10it/s]
	Class	Images	Instances	Box(P R		
	all	144	144	0.927	0.883	0.94 0.784

50 epochs completed in 1.772 hours.

Optimizer stripped from runs/detect/train8/weights/last.pt, 87.7MB

Optimizer stripped from runs/detect/train8/weights/best.pt, 87.7MB

Validating runs/detect/train8/weights/best.pt...

Ultralytics 8.3.48 🚀 Python-3.10.12 torch-2.5.1+cu121 CUDA:0 (Tesla T4, 15102MiB)

Model summary (fused): 268 layers, 43,626,654 parameters, 0 gradients, 164.9 GFLOPs

Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100% 5/5 [00:06<00:00, 1.31s/it]
all	144	144	0.92	0.876	0.954	0.793
A	5	5	0.758	0.632	0.928	0.785
B	9	9	0.987	0.889	0.975	0.857
C	3	3	0.935	1	0.995	0.863
D	6	6	0.838	0.865	0.972	0.819
E	4	4	0.962	1	0.995	0.872
F	8	8	0.878	0.875	0.982	0.81
G	5	5	0.973	1	0.995	0.869
H	9	9	0.982	1	0.995	0.789
I	2	2	0.587	0.5	0.503	0.453
J	8	8	0.994	1	0.995	0.706
K	6	6	0.97	0.667	0.893	0.734
L	4	4	0.94	0.75	0.945	0.751
M	8	8	1	0.948	0.995	0.832
N	4	4	0.991	1	0.995	0.839
O	7	7	0.996	1	0.995	0.781
P	7	7	0.997	1	0.995	0.77
Q	4	4	0.966	1	0.995	0.865
R	7	7	1	0.592	0.93	0.804
S	4	4	0.969	1	0.995	0.796
T	6	6	0.917	0.833	0.942	0.82
U	7	7	0.855	1	0.978	0.827
V	5	5	0.744	0.6	0.831	0.696
W	3	3	0.848	1	0.995	0.842
X	1	1	0.866	1	0.995	0.895
Y	8	8	1	0.638	0.995	0.687
Z	4	4	0.966	1	0.995	0.867

Speed: 0.6ms preprocess, 24.1ms inference, 0.0ms loss, 6.8ms postprocess per image

Results saved to runs/detect/train8

💡 Learn more at <https://docs.ultralytics.com/modes/train>

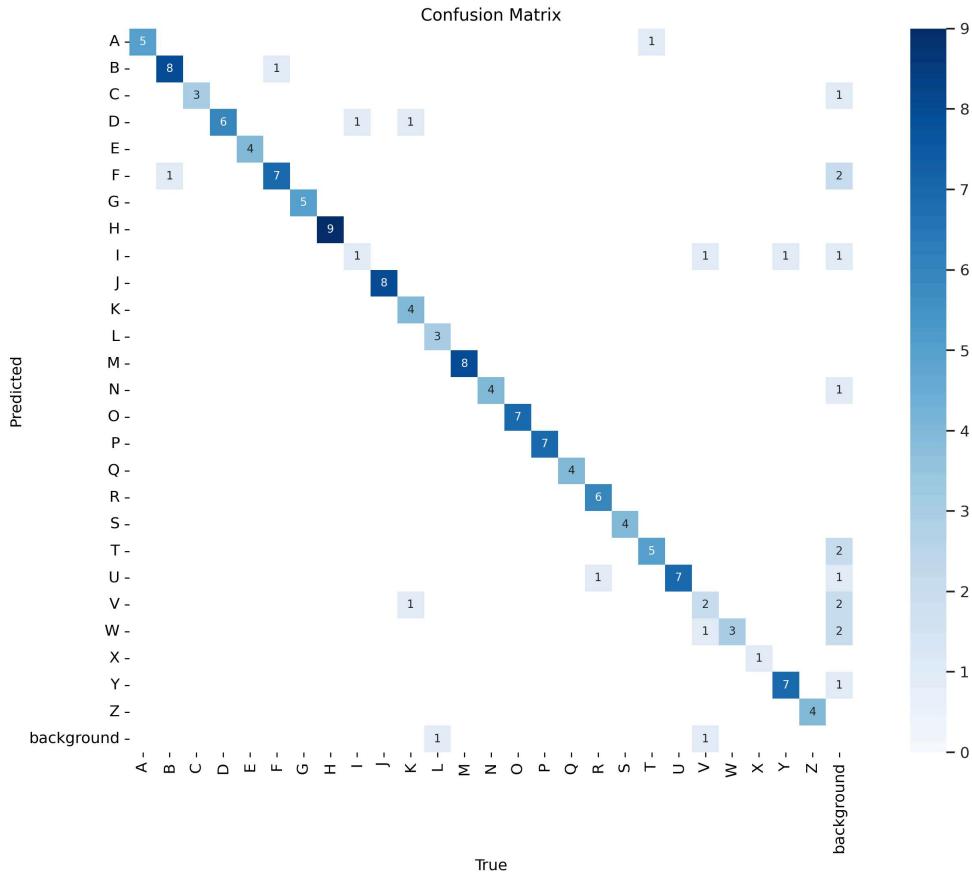
```
!ls {HOME}/runs/detect/train8/
```

args.yaml	R_curve.png	val_batch0_labels.jpg
confusion_matrix_normalized.png	results.csv	val_batch0_pred.jpg
confusion_matrix.png	results.png	val_batch1_labels.jpg
events.out.tfevents.1733735784.c36a069d0b86.5475.0	train_batch0.jpg	val_batch1_pred.jpg
F1_curve.png	train_batch1.jpg	val_batch2_labels.jpg
labels_correlogram.jpg	train_batch2.jpg	val_batch2_pred.jpg
labels.jpg	train_batch3800.jpg	weights
P_curve.png	train_batch3801.jpg	
PR_curve.png	train_batch3802.jpg	

## Displaying the Confusion Matrix

```
%cd {HOME}
Image(filename=f'{HOME}/runs/detect/train8/confusion_matrix.png', width=900)
```

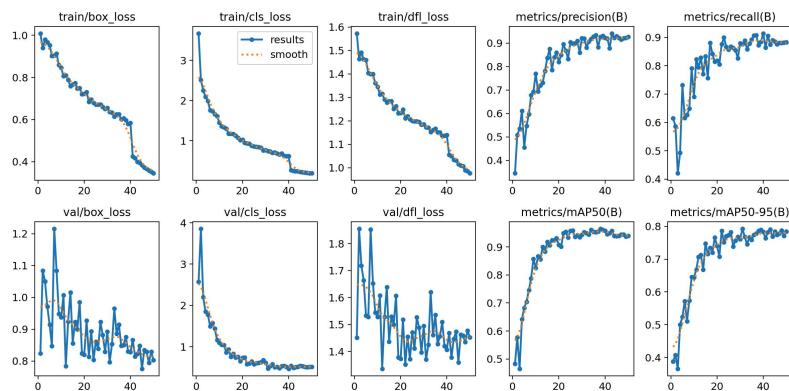
/content



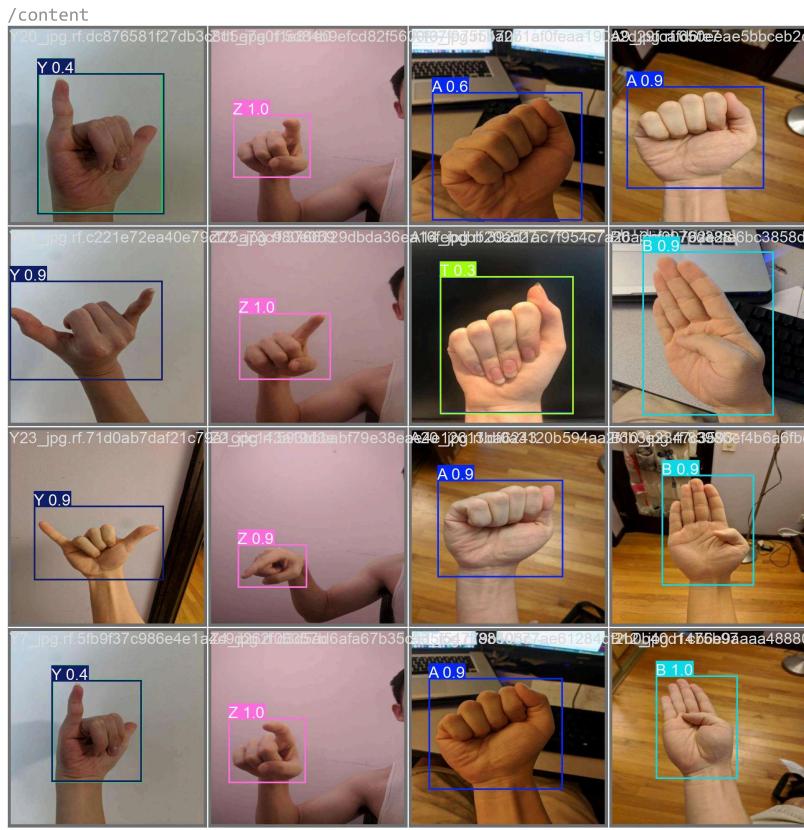
## Training and Validation Loss

```
%cd {HOME}
Image(filename=f'{HOME}/runs/detect/train8/results.png', width=600)
```

/content



```
%cd {HOME}
Image(filename=f'{HOME}/runs/detect/train8/val_batch0_pred.jpg', width=600)
```



## Validate Custom Model

```
%cd {HOME}
```

```
!yolo task=detect mode=val model={HOME}/runs/detect/train8/weights/best.pt data={dataset.location}/data.yaml
```

```
/content
Ultralytics 8.3.48 🚀 Python-3.10.12 torch-2.5.1+cu121 CUDA:0 (Tesla T4, 15102MiB)
Model summary (fused): 268 layers, 43,626,654 parameters, 0 gradients, 164.9 GFLOPs
val: Scanning /content/American-Sign-Language-Letters-1/valid/labels.cache...
144 images, 0 backgrounds, 0 corrupt: 100% 144/144 [00:00:00]
  Class   Images Instances   Box(P)      R    mAP50  mAP50-95: 100% 9/9 [00:08<00:00,  1.00it/s]
    all     144       144     0.92    0.876    0.953    0.793
    A       5         5     0.758    0.63    0.928    0.785
    B       9         9     0.987    0.889    0.975    0.857
    C       3         3     0.936    1        0.995    0.863
    D       6         6     0.838    0.866    0.972    0.819
    E       4         4     0.962    1        0.995    0.872
    F       8         8     0.878    0.875    0.982    0.81
    G       5         5     0.973    1        0.995    0.869
    H       9         9     0.982    1        0.995    0.789
    I       2         2     0.586    0.5      0.503    0.452
    J       8         8     0.993    1        0.995    0.724
    K       6         6     0.97      0.667    0.893    0.734
    L       4         4     0.94      0.75    0.912    0.728
    M       8         8     1        0.946    0.995    0.832
    N       4         4     0.991    1        0.995    0.839
    O       7         7     0.996    1        0.995    0.781
    P       7         7     0.997    1        0.995    0.77
    Q       4         4     0.966    1        0.995    0.865
    R       7         7     1        0.592    0.93     0.788
    S       4         4     0.969    1        0.995    0.796
    T       6         6     0.917    0.833    0.942     0.82
    U       7         7     0.855    1        0.978    0.827
    V       5         5     0.744    0.6      0.831    0.696
    W       3         3     0.847    1        0.995    0.842
    X       1         1     0.865    1        0.995    0.895
    Y       8         8     1        0.637    0.995    0.687
    Z       4         4     0.966    1        0.995    0.867

Speed: 0.4ms preprocess, 51.1ms inference, 0.0ms loss, 5.7ms postprocess per image
Results saved to runs/detect/val
💡 Learn more at https://docs.ultralytics.com/modes/val
```

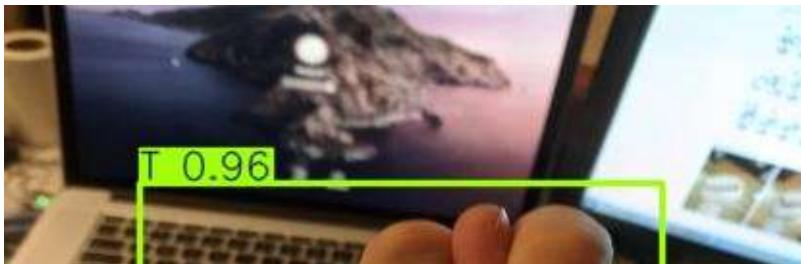
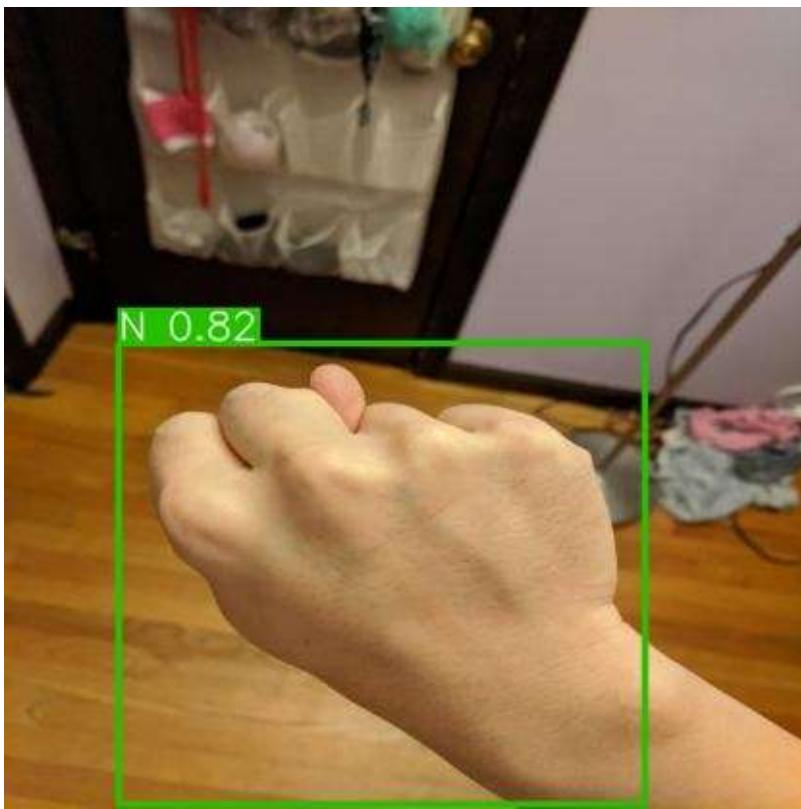
## ✓ Inference with Custom Model

```
%cd {HOME}
!yolo task=detect mode=predict model={HOME}/runs/detect/train8/weights/best.pt conf=0.25 source={dataset.location}/test/images

image 18/72 /content/American-Sign-Language-Letters-1/test/images/H25_.jpg.rf.dce08bcb4d091593ddaa19db8b0d2b155.jpg: 800x800 1 H, 58.1ms
image 19/72 /content/American-Sign-Language-Letters-1/test/images/H5_.jpg.rf.f7077ae3eb67ac9f01bd2914625a05b9.jpg: 800x800 1 H, 54.0ms
image 20/72 /content/American-Sign-Language-Letters-1/test/images/I17_.jpg.rf.8f1ed619e93147f7f9754a4edd8b90de.jpg: 800x800 1 I, 59.4ms
image 21/72 /content/American-Sign-Language-Letters-1/test/images/I28_.jpg.rf.74efc17a40df4bbd0bc63625be836201.jpg: 800x800 1 L, 57.4ms
image 22/72 /content/American-Sign-Language-Letters-1/test/images/J27_.jpg.rf.d8b9ca4ab3abf8436b2faab339881496.jpg: 800x800 1 J, 58.3ms
image 23/72 /content/American-Sign-Language-Letters-1/test/images/J28_.jpg.rf.e25320de48d1b6037555bcd85d28f0d.jpg: 800x800 1 J, 1 Q, !
image 24/72 /content/American-Sign-Language-Letters-1/test/images/J6_.jpg.rf.6db6cb7829752f430ec8344bc7605444.jpg: 800x800 1 J, 1 P, 5!
image 25/72 /content/American-Sign-Language-Letters-1/test/images/J9_.jpg.rf.213a9e356774a13d336e4988c33a93e1.jpg: 800x800 1 J, 58.1ms
image 26/72 /content/American-Sign-Language-Letters-1/test/images/K12_.jpg.rf.1bd849de853e33f626b664355e098f.jpg: 800x800 1 D, 58.5ms
image 27/72 /content/American-Sign-Language-Letters-1/test/images/K13_.jpg.rf.d544147ca4794793e996cbe309fcf28.jpg: 800x800 1 K, 56.8ms
image 28/72 /content/American-Sign-Language-Letters-1/test/images/K24_.jpg.rf.f1a48e003bf4bc8e3540590c972d57f3.jpg: 800x800 1 K, 58.1ms
image 29/72 /content/American-Sign-Language-Letters-1/test/images/K6_.jpg.rf.5f1f357165ba30376b667035f60fc6ce.jpg: 800x800 1 K, 1 P, 5!
image 30/72 /content/American-Sign-Language-Letters-1/test/images/M14_.jpg.rf.f7da6c9c9d9d3f5c6db468946f722cc.jpg: 800x800 1 N, 58.0ms
image 31/72 /content/American-Sign-Language-Letters-1/test/images/M20_.jpg.rf.aa9f2799d2cbe8f51363ec2862b427a6.jpg: 800x800 (no detect)
image 32/72 /content/American-Sign-Language-Letters-1/test/images/M24_.jpg.rf.f5f17e2ed1a7213e2a01f60f8afc158.jpg: 800x800 1 M, 57.4ms
image 33/72 /content/American-Sign-Language-Letters-1/test/images/N22_.jpg.rf.ac8a65cd21b7e4fd93128e6eb24329.jpg: 800x800 1 N, 57.3ms
image 34/72 /content/American-Sign-Language-Letters-1/test/images/N6_.jpg.rf.3899dd6cc1da66139de57126a250c175.jpg: 800x800 1 T, 58.2ms
image 35/72 /content/American-Sign-Language-Letters-1/test/images/N9_.jpg.rf.b92e9f54839f076f92f54388320fb7a3.jpg: 800x800 1 N, 57.6ms
image 36/72 /content/American-Sign-Language-Letters-1/test/images/O12_.jpg.rf.9103647cd190af96ac2a83f7bd1d0ae2.jpg: 800x800 1 O, 57.5ms
image 37/72 /content/American-Sign-Language-Letters-1/test/images/O20_.jpg.rf.517237686ec6346d6d72cb96b79cb3.jpg: 800x800 1 H, 56.7ms
image 38/72 /content/American-Sign-Language-Letters-1/test/images/O4_.jpg.rf.82c403d496488192d134b233a080d258.jpg: 800x800 1 O, 57.9ms
image 39/72 /content/American-Sign-Language-Letters-1/test/images/P24_.jpg.rf.67b98ae281f9a130f5e6f70ebb1e574f.jpg: 800x800 1 P, 57.3ms
image 40/72 /content/American-Sign-Language-Letters-1/test/images/Q10_.jpg.rf.87a66659eb5791bf51f56ff1e1883273.jpg: 800x800 1 Q, 57.5ms
image 41/72 /content/American-Sign-Language-Letters-1/test/images/Q7_.jpg.rf.07fdf6c096cd2a9be7b2b4de4a627935d.jpg: 800x800 1 Q, 58.1ms
image 42/72 /content/American-Sign-Language-Letters-1/test/images/R18_.jpg.rf.362d9bdb8ac7b512c7f73d25b36517.jpg: 800x800 1 R, 59.4ms
image 43/72 /content/American-Sign-Language-Letters-1/test/images/R5_.jpg.rf.1e94c77f430ee342744dc9fce202c449.jpg: 800x800 1 R, 57.5ms
image 44/72 /content/American-Sign-Language-Letters-1/test/images/S0_.jpg.rf.4466ad3687a4cfac9f6e447d89e121e.jpg: 800x800 (no detect)
image 45/72 /content/American-Sign-Language-Letters-1/test/images/S16_.jpg.rf.138a4aa81180adc24323c1634e5d07e.jpg: 800x800 1 S, 58.5ms
image 46/72 /content/American-Sign-Language-Letters-1/test/images/S6_.jpg.rf.0b6e42445a56998369ccdd3759c2cf3d4.jpg: 800x800 1 S, 58.8ms
image 47/72 /content/American-Sign-Language-Letters-1/test/images/T13_.jpg.rf.bf67ceb39727be048066c0de76801971.jpg: 800x800 1 T, 57.7ms
image 48/72 /content/American-Sign-Language-Letters-1/test/images/T17_.jpg.rf.7fecdf5c5e4e4574de71a65611579e0f.jpg: 800x800 1 T, 56.8ms
image 49/72 /content/American-Sign-Language-Letters-1/test/images/T18_.jpg.rf.334025dd29760be4f8918fd6d6c3f01c.jpg: 800x800 1 T, 57.1ms
image 50/72 /content/American-Sign-Language-Letters-1/test/images/T1_.jpg.rf.877948f560962d1e267a726179d1e9ed4.jpg: 800x800 1 N, 1 T, 5!
image 51/72 /content/American-Sign-Language-Letters-1/test/images/T24_.jpg.rf.068e7b2424eac996c86bb6d9c38e083d.jpg: 800x800 1 T, 57.5ms
image 52/72 /content/American-Sign-Language-Letters-1/test/images/U5_.jpg.rf.2be92300b664a1946dde8902dc50adbb.jpg: 800x800 1 U, 57.7ms
image 53/72 /content/American-Sign-Language-Letters-1/test/images/U6_.jpg.rf.5a219aee1c9d41d5fdeabdf6f78d0f68.jpg: 800x800 1 U, 58.1ms
image 54/72 /content/American-Sign-Language-Letters-1/test/images/V10_.jpg.rf.18af9b73cbe013f9a0640294fb71f0d6.jpg: 800x800 3 Ks, 1 W,
image 55/72 /content/American-Sign-Language-Letters-1/test/images/V12_.jpg.rf.0e68ec7ee88bd6f0f70f5496e893068.jpg: 800x800 1 V, 58.1ms
image 56/72 /content/American-Sign-Language-Letters-1/test/images/V27_.jpg.rf.c316e3cfddb7fe8d6ed9e06290b831c.jpg: 800x800 1 V, 57.8ms
image 57/72 /content/American-Sign-Language-Letters-1/test/images/V2_.jpg.rf.f887a9d681a64f8a2eef8375245ab4bb.jpg: 800x800 1 V, 57.7ms
image 58/72 /content/American-Sign-Language-Letters-1/test/images/W16_.jpg.rf.5771e4967321c7e827758319e697bed6.jpg: 800x800 1 W, 58.1ms
image 59/72 /content/American-Sign-Language-Letters-1/test/images/W19_.jpg.rf.62d8144c6b93960b18abeb70e34191b2a.jpg: 800x800 1 W, 59.4ms
image 60/72 /content/American-Sign-Language-Letters-1/test/images/W23_.jpg.rf.caecf7140a005d779f0950cc7c6a7616.jpg: 800x800 1 W, 58.2ms
image 61/72 /content/American-Sign-Language-Letters-1/test/images/W24_.jpg.rf.1bc37c6fc4770b284edc6f9027eb6cf2.jpg: 800x800 1 W, 56.6ms
image 62/72 /content/American-Sign-Language-Letters-1/test/images/W7_.jpg.rf.c80a52e6a95797bd8fcf3a03e4c701d99.jpg: 800x800 1 W, 57.8ms
image 63/72 /content/American-Sign-Language-Letters-1/test/images/X14_.jpg.rf.3c3c69ed80d0ce1688d1dde4b21f19f9.jpg: 800x800 1 X, 59.0ms
image 64/72 /content/American-Sign-Language-Letters-1/test/images/X20_.jpg.rf.2a36699005b7e1881efaa278c506b886.jpg: 800x800 1 X, 56.1ms
image 65/72 /content/American-Sign-Language-Letters-1/test/images/X24_.jpg.rf.ed6474bd56983fdb13576b2c3e9c0b7.jpg: 800x800 1 X, 57.5ms
image 66/72 /content/American-Sign-Language-Letters-1/test/images/X9_.jpg.rf.28187742b082579d85eda81fc98fb5bb.jpg: 800x800 1 X, 58.1ms
image 67/72 /content/American-Sign-Language-Letters-1/test/images/Y25_.jpg.rf.a8796b77d8c6370577ceacd3852b4b9.jpg: 800x800 1 Y, 59.0ms
image 68/72 /content/American-Sign-Language-Letters-1/test/images/Y5_.jpg.rf.86682b1ddac4546cc626ba99a61f42fc.jpg: 800x800 1 Y, 58.2ms
image 69/72 /content/American-Sign-Language-Letters-1/test/images/Z16_.jpg.rf.309328aae31736f8a93a570d6d4f140.jpg: 800x800 1 Q, 1 Z, !
image 70/72 /content/American-Sign-Language-Letters-1/test/images/Z18_.jpg.rf.2cffbd9beaeb50a7d03751c3ce738e81.jpg: 800x800 1 Z, 57.4ms
image 71/72 /content/American-Sign-Language-Letters-1/test/images/Z27_.jpg.rf.0a3e757898215b17678047cb5485c82c.jpg: 800x800 1 K, 1 Z, !
image 72/72 /content/American-Sign-Language-Letters-1/test/images/Z9_.jpg.rf.fd5bb2f80d391b73a85bbbd5bc5acc1.jpg: 800x800 1 Q, 1 Z, 5!
Speed: 3.4ms preprocess, 58.3ms inference, 14.3ms postprocess per image at shape (1, 3, 800, 800)
Results saved to runs/detect/predict
```

```
from IPython.display import Image, display # Import Image from IPython.display
```

```
for image_path in glob.glob(f'{HOME}/runs/detect/predict/*.jpg')[:3]:
    display(Image(filename=image_path, width=600))
    print("\n")
```





## ▼ Testing on a Demo Video

```
%cd {HOME}  
!yolo task=detect mode=predict model={HOME}/runs/detect/train8/weights/best.pt conf=0.25 source='/content/drive/MyDrive/Colab Notebooks/vide
```

```
video 1/1 (frame 191/897) /content/drive/MyDrive/Colab Notebooks/video_20241209_184223.mp4: 800x480 1 F, 30.1ms
video 1/1 (frame 192/897) /content/drive/MyDrive/Colab Notebooks/video_20241209_184223.mp4: 800x480 1 F, 29.2ms
video 1/1 (frame 193/897) /content/drive/MyDrive/Colab Notebooks/video_20241209_184223.mp4: 800x480 1 F, 29.3ms
video 1/1 (frame 194/897) /content/drive/MyDrive/Colab Notebooks/video_20241209_184223.mp4: 800x480 1 F, 29.5ms
video 1/1 (frame 195/897) /content/drive/MyDrive/Colab Notebooks/video_20241209_184223.mp4: 800x480 1 F, 29.8ms
video 1/1 (frame 196/897) /content/drive/MyDrive/Colab Notebooks/video_20241209_184223.mp4: 800x480 1 F, 29.2ms
video 1/1 (frame 197/897) /content/drive/MyDrive/Colab Notebooks/video_20241209_184223.mp4: 800x480 1 F, 29.5ms
video 1/1 (frame 198/897) /content/drive/MyDrive/Colab Notebooks/video_20241209_184223.mp4: 800x480 1 F, 30.0ms
video 1/1 (frame 199/897) /content/drive/MyDrive/Colab Notebooks/video_20241209_184223.mp4: 800x480 1 F, 29.5ms
```

## Display the Demo Video

```
#!rm "/content/result_compressed.mp4"
```

rm: cannot remove '/content/result\_compressed.mp4': No such file or directory

Double-click (or enter) to edit

```
from IPython.display import HTML
from base64 import b64encode
import os

# Input video path
save_path = '/content/runs/detect/predict3/video_20241209_184223.avi'

# Compressed video path
compressed_path = "/content/result_compressed2.mp4"

os.system(f"ffmpeg -i {save_path} -vcodec libx264 {compressed_path}")

# Show video
mp4 = open(compressed_path,'rb').read()
data_url = "data:video/mp4;base64," + b64encode(mp4).decode()
HTML("""
<video width=400 controls>
  <source src=\"%s\" type=\"video/mp4\">
</video>
""" % data_url)
```