T.C.
SAKARYA ÜNİVERSİTESİ
BİLGİSAYAR VE BİLİŞİM BİLİMLERİ FAKÜLTESİ

ISE 401 BİLİŞİM SİSTEMLERİ MÜHENDİSLİĞİ BİTİRME ÇALIŞMASI

BİLGİSAYARLI GÖRÜ TEKNOLOJİLERİNİ KULLANARAK İŞ YERLERİNDE KKD KULLANIM DURUMUNU DENETLEYEN KAMERA

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Bölüm	**:**	**BİLİŞİM SİSTEMLERİ MÜHENDİSLİĞİ**
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YOLOv4 ile Modeli Eğitme

Drive Bağlantısı

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

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True)
```

Sistem Özellikleri

```
%cat /etc/lsb-release
```

```
DISTRIB_ID=Ubuntu
DISTRIB_RELEASE=18.04
DISTRIB_CODENAME=bionic
DISTRIB_DESCRIPTION="Ubuntu 18.04.5 LTS"
```

Depolama Alanı Gücelleme

```
!apt-get update
```

```
Hit:1 https://developer.download.nvidia.com/compute/cuda/repos/ubuntu1804/x86_64  InRelease
Hit:2 https://cloud.r-project.org/bin/linux/ubuntu bionic-cran40/ InRelease
Hit:3 http://security.ubuntu.com/ubuntu bionic-security InRelease
Ign:4 https://developer.download.nvidia.com/compute/machine-learning/repos/ubuntu1804/x86_64  InRelease
```

```
Hit:5 https://developer.download.nvidia.com/compute/machine-learning/repos/ubuntu1804/x86_64  Release
Hit:6 http://archive.ubuntu.com/ubuntu bionic InRelease
Hit:7 http://ppa.launchpad.net/c2d4u.team/c2d4u4.0+/ubuntu bionic InRelease
Hit:9 http://archive.ubuntu.com/ubuntu bionic-updates InRelease
Hit:10 http://archive.ubuntu.com/ubuntu bionic-backports InRelease
Hit:11 http://ppa.launchpad.net/cran/libgit2/ubuntu bionic InRelease
Hit:12 http://ppa.launchpad.net/deadsnakes/ppa/ubuntu bionic InRelease
Hit:13 http://ppa.launchpad.net/graphics-drivers/ppa/ubuntu bionic InRelease
Reading package lists... Done
```

Adres Öğrenme

```
%pwd
```

```
'/content'
```

Darknet dosyasını zip'ten çıkarma

```
!unzip "/content/drive/MyDrive/yolo_helmet_model/darknet.zip"
```

```
  inflating: darknet/src/getopt.c
  inflating: darknet/src/getopt.h
  inflating: darknet/src/gettimeofday.c
  inflating: darknet/src/gettimeofday.h
  inflating: darknet/src/go.c
  inflating: darknet/src/gru_layer.c
  inflating: darknet/src/gru_layer.h
  inflating: darknet/src/http_stream.cpp
  inflating: darknet/src/http_stream.h
  inflating: darknet/src/httplib.h
  inflating: darknet/src/im2col.c
  inflating: darknet/src/im2col.h
  inflating: darknet/src/im2col_kernels.cu
  inflating: darknet/src/image.c
  inflating: darknet/src/image.h
```

```
inflating: darknet/src/image_opencv.cpp
inflating: darknet/src/image_opencv.h
inflating: darknet/src/layer.c
inflating: darknet/src/layer.h
inflating: darknet/src/list.c
inflating: darknet/src/list.h
inflating: darknet/src/local_layer.c
inflating: darknet/src/local_layer.h
inflating: darknet/src/lstm_layer.c
inflating: darknet/src/lstm_layer.h
inflating: darknet/src/matrix.c
inflating: darknet/src/matrix.h
inflating: darknet/src/maxpool_layer.c
inflating: darknet/src/maxpool_layer.h
inflating: darknet/src/maxpool_layer_kernels.cu
inflating: darknet/src/network.c
inflating: darknet/src/network.h
inflating: darknet/src/network_kernels.cu
inflating: darknet/src/nightmare.c
inflating: darknet/src/normalization_layer.c
inflating: darknet/src/normalization_layer.h
inflating: darknet/src/option_list.c
inflating: darknet/src/option_list.h
inflating: darknet/src/parser.c
inflating: darknet/src/parser.h
inflating: darknet/src/region_layer.c
inflating: darknet/src/region_layer.h
inflating: darknet/src/reorg_layer.c
inflating: darknet/src/reorg_layer.h
inflating: darknet/src/reorg_old_layer.c
inflating: darknet/src/reorg_old_layer.h
inflating: darknet/src/representation_layer.c
inflating: darknet/src/representation_layer.h
inflating: darknet/src/rnn.c
inflating: darknet/src/rnn_layer.c
inflating: darknet/src/rnn_layer.h
inflating: darknet/src/rnn_vid.c
inflating: darknet/src/route_layer.c
inflating: darknet/src/route_layer.h
inflating: darknet/src/sam_layer.c
inflating: darknet/src/sam_layer.h
inflating: darknet/src/scale_channels_layer.c
```

```
inflating: darknet/src/scale_channels_layer.c
inflating: darknet/src/scale_channels_layer.h
inflating: darknet/src/shortcut_layer.c
```

Change Directory (adres ayarlama)

```
%cd /content/darknet
```

```
/content/darknet
```

```
%pwd
```

```
'/content/darknet'
```

Dosyaları unix'in anlayabileceği biçime çevirme

```
!sudo apt install dos2unix
```

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer required:
  libnvidia-common-460
Use 'sudo apt autoremove' to remove it.
The following NEW packages will be installed:
  dos2unix
0 upgraded, 1 newly installed, 0 to remove and 47 not upgraded.
Need to get 351 kB of archives.
After this operation, 1,267 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu bionic/universe amd64 dos2unix amd64 7.3.4-3 [351 kB]
Fetched 351 kB in 1s (249 kB/s)
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based frontend cannot be used. at /usr/share/perl5/Debconf/
debconf: falling back to frontend: Readline
```

```
debconf: unable to initialize frontend: Readline
debconf: (This frontend requires a controlling tty.)
debconf: falling back to frontend: Teletype
dpkg-preconfigure: unable to re-open stdin:
Selecting previously unselected package dos2unix.
(Reading database ... 155629 files and directories currently installed.)
Preparing to unpack .../dos2unix_7.3.4-3_amd64.deb ...
Unpacking dos2unix (7.3.4-3) ...
Setting up dos2unix (7.3.4-3) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
```

```
!find . -type f -print0 | xargs -0 dos2unix
```

```
dos2unix: Binary symbol 0x1A found at line 2
dos2unix: Skipping binary file ./data/labels/79_0.png
dos2unix: Binary symbol 0x1A found at line 2
dos2unix: Skipping binary file ./data/labels/59_3.png
dos2unix: Binary symbol 0x1A found at line 2
dos2unix: Skipping binary file ./data/labels/80_3.png
dos2unix: Binary symbol 0x1A found at line 2
dos2unix: Skipping binary file ./data/labels/33_2.png
dos2unix: Binary symbol 0x1A found at line 2
dos2unix: Skipping binary file ./data/labels/120_6.png
dos2unix: Binary symbol 0x1A found at line 2
dos2unix: Skipping binary file ./data/labels/41_7.png
dos2unix: Binary symbol 0x1A found at line 2
dos2unix: Skipping binary file ./data/labels/60_7.png
dos2unix: Binary symbol 0x1A found at line 2
dos2unix: Skipping binary file ./data/labels/123_7.png
dos2unix: Binary symbol 0x1A found at line 2
dos2unix: Skipping binary file ./data/labels/112_2.png
dos2unix: Binary symbol 0x1A found at line 2
dos2unix: Skipping binary file ./data/labels/42_3.png
dos2unix: Binary symbol 0x1A found at line 2
dos2unix: Skipping binary file ./data/labels/114_5.png
dos2unix: Binary symbol 0x00 found at line 1
dos2unix: Skipping binary file ./data/person.jpg
dos2unix: converting file ./data/imagenet.labels.list to Unix format...
dos2unix: converting file ./data/voc.names to Unix format...
dos2unix: Binary symbol 0x00 found at line 1
```

```
dos2unix: Skipping binary file ./data/eagle.jpg
dos2unix: converting file ./data/coco9k.map to Unix format...
dos2unix: Binary symbol 0x00 found at line 1
dos2unix: Skipping binary file ./data/giraffe.jpg
dos2unix: Binary symbol 0x00 found at line 1
dos2unix: Skipping binary file ./data/scream.jpg
dos2unix: Binary symbol 0x02 found at line 1
dos2unix: Skipping binary file ./data/dog.jpg
dos2unix: converting file ./build.ps1 to Unix format...
dos2unix: converting file ./results/tmp.txt to Unix format...
dos2unix: converting file ./CMakeLists.txt to Unix format...
dos2unix: converting file ./vcpkg.json to Unix format...
dos2unix: Binary symbol 0x00 found at line 1
dos2unix: Skipping binary file ./helmet_yolov4_last.weights
dos2unix: Binary symbol 0x00 found at line 1
dos2unix: Skipping binary file ./helmet_yolov4_best.weights
dos2unix: Binary symbol 0x00 found at line 1
dos2unix: Skipping binary file ./yolov4.conv.137
dos2unix: converting file ./.gitignore to Unix format...
dos2unix: converting file ./scripts/download_weights.ps1 to Unix format...
dos2unix: converting file ./scripts/voc_eval.py to Unix format...
dos2unix: converting file ./scripts/reval_voc_py3.py to Unix format...
dos2unix: converting file ./scripts/requested_cuda_version.sh to Unix format...
dos2unix: converting file ./scripts/get_coco2017.sh to Unix format...
dos2unix: converting file ./scripts/setup.ps1 to Unix format...
dos2unix: converting file ./scripts/gen_tactic.sh to Unix format...
dos2unix: converting file ./scripts/kmeansiou.c to Unix format...
dos2unix: converting file ./scripts/setup.sh to Unix format...
dos2unix: converting file ./scripts/get_imagenet_train.sh to Unix format...
dos2unix: converting file ./scripts/voc_label.py to Unix format...
dos2unix: converting file ./scripts/voc_label_difficult.py to Unix format...
dos2unix: converting file ./scripts/get_openimages_dataset.py to Unix format...
```

Darknet dosyalarını çalıştırabilmek için linux'tan izin alma

```
!chmod +x /content/darknet
```

Dosyaları çalıştırma

```
!make
```

```
nvcc -gencode arch=compute_35,code=sm_35 -gencode arch=compute_50,code=[sm_50,compute_50] -gencode arch=compute_52,code=[sm_5
nvcc warning : The 'compute_35', 'compute_37', 'compute_50', 'sm_35', 'sm_37' and 'sm_50' architectures are deprecated, and m
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags opencv4 2> /dev/null || pkg-config
g++ -std=c++11 -shared -std=c++11 -fvisibility=hidden -DLIB_EXPORTS -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --
In file included from src/yolo_v2_class.cpp:2:0:
include/yolo_v2_class.hpp: In member function ‘void track_kalman_t::clear_old_states()’:
include/yolo_v2_class.hpp:879:50: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
                 if ((result_vec_pred[state_id].x > img_size.width) ||
include/yolo_v2_class.hpp:880:50: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
                     (result_vec_pred[state_id].y > img_size.height))
include/yolo_v2_class.hpp: In member function ‘track_kalman_t::tst_t track_kalman_t::get_state_id(bbox_t, std::vector<bool>&)
include/yolo_v2_class.hpp:900:30: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
         for (size_t i = 0; i < max_objects; ++i)
                            ~~^~~~~~~~~~~~~
include/yolo_v2_class.hpp: In member function ‘std::vector<bbox_t> track_kalman_t::predict()’:
include/yolo_v2_class.hpp:990:30: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
         for (size_t i = 0; i < max_objects; ++i)
                            ~~^~~~~~~~~~~~~
include/yolo_v2_class.hpp: In member function ‘std::vector<bbox_t> track_kalman_t::correct(std::vector<bbox_t>)’:
include/yolo_v2_class.hpp:1025:30: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
         for (size_t i = 0; i < max_objects; ++i)
                            ~~^~~~~~~~~~~~~
src/yolo_v2_class.cpp: In member function ‘std::vector<bbox_t> Detector::tracking_id(std::vector<bbox_t>, bool, int, int)’:
src/yolo_v2_class.cpp:439:40: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
         if (prev_bbox_vec_deque.size() > frames_story) prev_bbox_vec_deque.pop_back();
             ~~~~~~~~~~~~~~~~~~~~~~~~~~~^~~~~~~~~~~~~~
src/yolo_v2_class.cpp:454:34: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
                     if (cur_dist < max_dist && (k.track_id == 0 || dist_vec[m] > cur_dist)) {
                         ~~~~~~~~~~^~~~~~~~~~
src/yolo_v2_class.cpp:478:40: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
         if (prev_bbox_vec_deque.size() > frames_story) prev_bbox_vec_deque.pop_back();
             ~~~~~~~~~~~~~~~~~~~~~~~~~~~^~~~~~~~~~~~~~
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags opencv4 2> /dev/null || pkg-config
In file included from src/yolo_console_dll.cpp:23:0:
```

```
include/yolo_v2_class.hpp: In member function ‘void track_kalman_t::clear_old_states()’:
include/yolo_v2_class.hpp:879:50: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
                if ((result_vec_pred[state_id].x > img_size.width) ||
include/yolo_v2_class.hpp:880:50: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
                    (result_vec_pred[state_id].y > img_size.height))
include/yolo_v2_class.hpp: In member function ‘track_kalman_t::tst_t track_kalman_t::get_state_id(bbox_t, std::vector<bool>&)
include/yolo_v2_class.hpp:900:30: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
         for (size_t i = 0; i < max_objects; ++i)
                            ~~^~~~~~~~~~~~~
include/yolo_v2_class.hpp: In member function ‘std::vector<bbox_t> track_kalman_t::predict()’:
include/yolo_v2_class.hpp:990:30: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
         for (size_t i = 0; i < max_objects; ++i)
                            ~~^~~~~~~~~~~~~
include/yolo_v2_class.hpp: In member function ‘std::vector<bbox_t> track_kalman_t::correct(std::vector<bbox_t>)’:
include/yolo_v2_class.hpp:1025:30: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
         for (size_t i = 0; i < max_objects; ++i)
                            ~~^~~~~~~~~~~~~
src/yolo_console_dll.cpp: In function ‘void draw_boxes(cv::Mat, std::vector<bbox_t>, std::vector<std::__cxx11::basic_string<c
src/yolo_console_dll.cpp:192:46: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
             int max_width = (text_size.width > i.w + 2) ? text_size.width : (i.w + 2);
                              ~~~~~~~~~~~~~~~~~^~~~~~~~~
src/yolo_console_dll.cpp:201:62: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
                int const max_width_3d = (text_size_3d.width > i.w + 2) ? text_size_3d.width : (i.w + 2);
```

Var olan backup dosyasını silme

```
!rm /content/darknet/backup -r
```

Drive/backup bağlantısı

```
!ln -s /content/drive/"My Drive"/helmet_weights/backup /content/darknet
```

```
%pwd
```

```
'/content/darknet'
```

Eğitime başlama

```
!./darknet detector train helmet_data/helmet.data helmet_yolov4.cfg yolov4.conv.137 -map -dont_show
```

```
Streaming output truncated to the last 5000 lines.
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.839385), count: 6, class_loss = 0.008979,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.808273), count: 6, class_loss = 0.000031,
 total_bbox = 1664159, rewritten_bbox = 0.004507 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.823067), count: 6, class_loss = 0.010874,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.864592), count: 10, class_loss = 0.473237,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.889218), count: 4, class_loss = 0.000012,
 total_bbox = 1664179, rewritten_bbox = 0.004507 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.000000), count: 1, class_loss = 0.000001,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.873940), count: 10, class_loss = 0.114872,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.876858), count: 8, class_loss = 0.016295,
 total_bbox = 1664197, rewritten_bbox = 0.004507 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.839084), count: 14, class_loss = 0.588584,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.818904), count: 13, class_loss = 0.790432,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.882851), count: 2, class_loss = 0.000023,
 total_bbox = 1664226, rewritten_bbox = 0.004507 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.000000), count: 1, class_loss = 0.015559,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.784378), count: 12, class_loss = 1.821480,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.824821), count: 9, class_loss = 0.536774,
 total_bbox = 1664247, rewritten_bbox = 0.004507 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.741643), count: 1, class_loss = 0.025482,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.826736), count: 7, class_loss = 0.164848,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.822351), count: 4, class_loss = 0.000291,
 total_bbox = 1664259, rewritten_bbox = 0.004507 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.791318), count: 2, class_loss = 0.001564,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.831263), count: 11, class_loss = 0.026039,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.825262), count: 7, class_loss = 0.240768,
 total_bbox = 1664279, rewritten_bbox = 0.004506 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.000000), count: 1, class_loss = 0.000027,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.853065), count: 8, class_loss = 0.477698,
```

```
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.807616), count: 7, class_loss = 0.249314,
 total_bbox = 1664294, rewritten_bbox = 0.004506 %

 (next mAP calculation at 2500 iterations)
 Last accuracy mAP@0.50 = 98.66 %, best = 98.89 %
 2401: 0.529594, 1.052707 avg loss, 0.001300 rate, 8.071271 seconds, 115248 images, 2.754213 hours left
Loaded: 0.000034 seconds
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.595383), count: 1, class_loss = 0.495468,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.811719), count: 11, class_loss = 0.688930,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.826101), count: 6, class_loss = 0.864813,
 total_bbox = 1664312, rewritten_bbox = 0.004506 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.000000), count: 1, class_loss = 0.000015,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.828159), count: 5, class_loss = 0.002454,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.845876), count: 4, class_loss = 0.000048,
 total_bbox = 1664321, rewritten_bbox = 0.004506 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.756124), count: 2, class_loss = 0.001584,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.785258), count: 3, class_loss = 0.041692,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.908126), count: 2, class_loss = 0.001334,
 total_bbox = 1664328, rewritten_bbox = 0.004506 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.000000), count: 1, class_loss = 0.000018,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.879107), count: 14, class_loss = 0.005084,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.856886), count: 6, class_loss = 0.002871,
 total_bbox = 1664348, rewritten_bbox = 0.004506 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.828325), count: 7, class_loss = 1.266538,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.796983), count: 30, class_loss = 2.624050,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.850951), count: 12, class_loss = 1.870503,
 total_bbox = 1664397, rewritten_bbox = 0.004506 %
```

Bağlantı kopmalarından dolayı duran eğitimi kaldığı yerden devam ettirme

```
!./darknet detector train helmet_data/helmet.data helmet_yolov4.cfg /content/darknet/backup/helmet_yolov4_last.weights -dont_show -ma
```

```
Streaming output truncated to the last 5000 lines.
 Last accuracy mAP@0.50 = 97.32 %, best = 97.32 %
 3951: 0.895785, 0.692096 avg loss, 0.000130 rate, 19.673283 seconds, 189648 images, 0.569867 hours left
Loaded: 0.000050 seconds
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.817293), count: 9, class_loss = 0.691606,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.849188), count: 18, class_loss = 0.191540,
```

```
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.876568), count: 6, class_loss = 0.002393,
 total_bbox = 240091, rewritten_bbox = 0.001666 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.000000), count: 1, class_loss = 0.000002,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.861178), count: 2, class_loss = 0.008181,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.844886), count: 7, class_loss = 0.076592,
 total_bbox = 240100, rewritten_bbox = 0.001666 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.851373), count: 2, class_loss = 0.852962,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.853002), count: 7, class_loss = 0.069823,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.905137), count: 3, class_loss = 0.000073,
 total_bbox = 240112, rewritten_bbox = 0.001666 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.000000), count: 1, class_loss = 0.000000,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.957831), count: 1, class_loss = 0.000064,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.869307), count: 4, class_loss = 0.000046,
 total_bbox = 240117, rewritten_bbox = 0.001666 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.756787), count: 10, class_loss = 3.455758,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.812878), count: 22, class_loss = 8.267963,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.817685), count: 6, class_loss = 1.882792,
 total_bbox = 240155, rewritten_bbox = 0.001666 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.922843), count: 1, class_loss = 0.043885,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.825583), count: 15, class_loss = 2.622674,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.832292), count: 6, class_loss = 0.740400,
 total_bbox = 240177, rewritten_bbox = 0.001665 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.865780), count: 6, class_loss = 0.917296,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.886178), count: 15, class_loss = 0.262782,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.911518), count: 9, class_loss = 0.223617,
 total_bbox = 240206, rewritten_bbox = 0.001665 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.873185), count: 6, class_loss = 0.073017,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.871966), count: 32, class_loss = 0.022635,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.879655), count: 13, class_loss = 0.003892,
 total_bbox = 240257, rewritten_bbox = 0.001665 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.751118), count: 8, class_loss = 1.117883,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.895657), count: 8, class_loss = 0.635673,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.885853), count: 6, class_loss = 1.082497,
 total_bbox = 240279, rewritten_bbox = 0.001665 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.825173), count: 2, class_loss = 0.354142,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.903162), count: 19, class_loss = 0.027143,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.917432), count: 13, class_loss = 0.020949,
 total_bbox = 240313, rewritten_bbox = 0.001664 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.811336), count: 1, class_loss = 0.348651,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.878106), count: 21, class_loss = 3.045713,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.853509), count: 13, class_loss = 1.106468,
```

```
 total_bbox = 240348, rewritten_bbox = 0.001664 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.863950), count: 5, class_loss = 0.037899,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.847332), count: 18, class_loss = 1.010767,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.897730), count: 7, class_loss = 0.044105,
 total_bbox = 240378, rewritten_bbox = 0.001664 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.865264), count: 6, class_loss = 0.587050,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.823128), count: 17, class_loss = 1.734649,
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.827289), count: 8, class_loss = 1.886373,
 total_bbox = 240409, rewritten_bbox = 0.001664 %
```

Backup Dosyaları

```
!ls /content/darknet/backup
```

```
helmet_yolov4_1000.weights  helmet_yolov4_best.weights
helmet_yolov4_2000.weights  helmet_yolov4_final.weights
helmet_yolov4_3000.weights  helmet_yolov4_last.weights
helmet_yolov4_4000.weights
```

Model İstatistikleri

```
!./darknet detector map helmet_data/helmet.data helmet_yolov4.cfg /content/drive/MyDrive/helmet_weights/backup/helmet_yolov4_last.wei
```

```
 136 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
 137 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
 138 conv     21       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x  21 0.029 BF
 139 yolo
[yolo] params: iou loss: ciou (4), iou_norm: 0.07, obj_norm: 1.00, cls_norm: 1.00, delta_norm: 1.00, scale_x_y: 1.20
nms_kind: greedynms (1), beta = 0.600000
 140 route  136                                           ->   52 x  52 x 128
 141 conv    256       3 x 3/ 2     52 x  52 x 128 ->   26 x  26 x 256 0.399 BF
 142 route  141 126                                     ->   26 x  26 x 512
 143 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
 144 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
```

```
 145 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
 146 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
 147 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
 148 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
 149 conv     21       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x  21 0.015 BF
 150 yolo
[yolo] params: iou loss: ciou (4), iou_norm: 0.07, obj_norm: 1.00, cls_norm: 1.00, delta_norm: 1.00, scale_x_y: 1.10
nms_kind: greedynms (1), beta = 0.600000
 151 route  147                                           ->   26 x  26 x 256
 152 conv    512       3 x 3/ 2     26 x  26 x 256 ->   13 x  13 x 512 0.399 BF
 153 route  152 116                                   ->   13 x  13 x1024
 154 conv    512       1 x 1/ 1     13 x  13 x1024 ->   13 x  13 x 512 0.177 BF
 155 conv   1024       3 x 3/ 1     13 x  13 x 512 ->   13 x  13 x1024 1.595 BF
 156 conv    512       1 x 1/ 1     13 x  13 x1024 ->   13 x  13 x 512 0.177 BF
 157 conv   1024       3 x 3/ 1     13 x  13 x 512 ->   13 x  13 x1024 1.595 BF
 158 conv    512       1 x 1/ 1     13 x  13 x1024 ->   13 x  13 x 512 0.177 BF
 159 conv   1024       3 x 3/ 1     13 x  13 x 512 ->   13 x  13 x1024 1.595 BF
 160 conv     21       1 x 1/ 1     13 x  13 x1024 ->   13 x  13 x  21 0.007 BF
 161 yolo
[yolo] params: iou loss: ciou (4), iou_norm: 0.07, obj_norm: 1.00, cls_norm: 1.00, delta_norm: 1.00, scale_x_y: 1.05
nms_kind: greedynms (1), beta = 0.600000
Total BFLOPS 59.570
avg_outputs = 489910
 Allocate additional workspace_size = 12.46 MB
Loading weights from /content/drive/MyDrive/helmet_weights/backup/helmet_yolov4_last.weights...
 seen 64, trained: 192 K-images (3 Kilo-batches_64)
Done! Loaded 162 layers from weights-file

 calculation mAP (mean average precision)...
 Detection layer: 139 - type = 28
 Detection layer: 150 - type = 28
 Detection layer: 161 - type = 28
192
 detections_count = 599, unique_truth_count = 450
class_id = 0, name = No Helmet, ap = 95.94%      (TP = 156, FP = 20)
class_id = 1, name = Helmet , ap = 98.64%        (TP = 283, FP = 16)

 for conf_thresh = 0.25, precision = 0.92, recall = 0.98, F1-score = 0.95
 for conf_thresh = 0.25, TP = 439, FP = 36, FN = 11, average IoU = 77.41 %

 IoU threshold = 50 %, used Area-Under-Curve for each unique Recall
```

```
 mean average precision (mAP@0.50) = 0.972878, or 97.29 %
Total Detection Time: 15 Seconds

Set -points flag:
 `-points 101` for MS COCO
 `-points 11` for PascalVOC 2007 (uncomment `difficult` in voc.data)
```

✓ 26 sn. tamamlanma zamanı: 15:07

Webcam Üzerinden Object Deteciton

```
# gerekli kütüphaneleri import etme
from IPython.display import display, Javascript, Image
from google.colab.output import eval_js
from google.colab.patches import cv2_imshow
from base64 import b64decode, b64encode
import cv2
import numpy as np
import PIL
import io
import html
import time
import matplotlib.pyplot as plt
%matplotlib inline
```

Drive Bağlantısı

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

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

Darknet dosyasını zip'ten çıkarma

```
!unzip "/content/drive/MyDrive/helmet_model/darknet.zip"
```

```
Archive:  /content/drive/MyDrive/helmet_model/darknet.zip
```

```
   creating: darknet/.circleci/
  inflating: darknet/.circleci/config.yml
  inflating: darknet/.gitignore
   creating: darknet/3rdparty/
   creating: darknet/3rdparty/pthreads/
   creating: darknet/3rdparty/pthreads/bin/
  inflating: darknet/3rdparty/pthreads/bin/pthreadGC2.dll
  inflating: darknet/3rdparty/pthreads/bin/pthreadVC2.dll
   creating: darknet/3rdparty/pthreads/include/
  inflating: darknet/3rdparty/pthreads/include/pthread.h
  inflating: darknet/3rdparty/pthreads/include/sched.h
  inflating: darknet/3rdparty/pthreads/include/semaphore.h
   creating: darknet/3rdparty/pthreads/lib/
  inflating: darknet/3rdparty/pthreads/lib/libpthreadGC2.a
  inflating: darknet/3rdparty/pthreads/lib/pthreadVC2.lib
   creating: darknet/3rdparty/stb/
   creating: darknet/3rdparty/stb/include/
  inflating: darknet/3rdparty/stb/include/stb_image.h
  inflating: darknet/3rdparty/stb/include/stb_image_write.h
  inflating: darknet/build.ps1
   creating: darknet/build/
   creating: darknet/build/darknet/
  inflating: darknet/build/darknet/darknet.sln
  inflating: darknet/build/darknet/darknet.vcxproj
  inflating: darknet/build/darknet/darknet_no_gpu.sln
  inflating: darknet/build/darknet/darknet_no_gpu.vcxproj
   creating: darknet/build/darknet/x64/
   creating: darknet/build/darknet/x64/backup/
 extracting: darknet/build/darknet/x64/backup/tmp.txt
  inflating: darknet/build/darknet/x64/calc_anchors.cmd
  inflating: darknet/build/darknet/x64/calc_mAP.cmd
  inflating: darknet/build/darknet/x64/calc_mAP_coco.cmd
  inflating: darknet/build/darknet/x64/calc_mAP_voc_py.cmd
   creating: darknet/build/darknet/x64/cfg/
  inflating: darknet/build/darknet/x64/cfg/alexnet.cfg
  inflating: darknet/build/darknet/x64/cfg/cd53paspp-gamma.cfg
  inflating: darknet/build/darknet/x64/cfg/cifar.cfg
  inflating: darknet/build/darknet/x64/cfg/cifar.test.cfg
  inflating: darknet/build/darknet/x64/cfg/coco.data
  inflating: darknet/build/darknet/x64/cfg/combine9k.data
  inflating: darknet/build/darknet/x64/cfg/crnn.train.cfg
```

```
  inflating: darknet/build/darknet/x64/cfg/csdarknet53-omega.cfg
  inflating: darknet/build/darknet/x64/cfg/cspx-p7-mish.cfg
  inflating: darknet/build/darknet/x64/cfg/cspx-p7-mish_hp.cfg
  inflating: darknet/build/darknet/x64/cfg/cspx-p7-mish-omega.cfg
  inflating: darknet/build/darknet/x64/cfg/csresnext50-panet-spp.cfg
  inflating: darknet/build/darknet/x64/cfg/csresnext50-panet-spp-original-optimal.cfg
  inflating: darknet/build/darknet/x64/cfg/darknet.cfg
  inflating: darknet/build/darknet/x64/cfg/darknet19.cfg
  inflating: darknet/build/darknet/x64/cfg/darknet19_448.cfg
  inflating: darknet/build/darknet/x64/cfg/darknet53.cfg
  inflating: darknet/build/darknet/x64/cfg/darknet53_448_xnor.cfg
  inflating: darknet/build/darknet/x64/cfg/densenet201.cfg
  inflating: darknet/build/darknet/x64/cfg/efficientnet_b0.cfg
  inflating: darknet/build/darknet/x64/cfg/efficientnet-lite3.cfg
  inflating: darknet/build/darknet/x64/cfg/enet-coco.cfg
```

Change Directory (adres ayarlama)

```
%cd /content/darknet
```

```
/content/darknet
```

Dosyaları unix'in anlayabileceği biçime çevirme

```
!sudo apt install dos2unix
```

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libnvidia-common-460 nsight-compute-2020.2.0
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  dos2unix
0 upgraded, 1 newly installed, 0 to remove and 67 not upgraded.
```

```
Need to get 351 kB of archives.
After this operation, 1,267 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu bionic/universe amd64 dos2unix amd64 7.3.4-3 [351 kB]
Fetched 351 kB in 1s (486 kB/s)
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based frontend cannot be used. at /usr/share/perl5/Debconf/
debconf: falling back to frontend: Readline
debconf: unable to initialize frontend: Readline
debconf: (This frontend requires a controlling tty.)
debconf: falling back to frontend: Teletype
dpkg-preconfigure: unable to re-open stdin:
Selecting previously unselected package dos2unix.
(Reading database ... 155203 files and directories currently installed.)
Preparing to unpack .../dos2unix_7.3.4-3_amd64.deb ...
Unpacking dos2unix (7.3.4-3) ...
Setting up dos2unix (7.3.4-3) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
```

```
!find . type f print0 | xargs -0 dos2unix
```

```
xargs: argument line too long
```

Darknet dosyalarını çalıştırabilmek için linux'tan izin alma

```
!chmod +x /content/darknet
```

Dosyaları çalıştırma

```
!make
```

```
mkdir -p ./obj/
mkdir -p backup
```

```
chmod +x *.sh
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags opencv4 2> /dev/null || pkg-config
./src/image_opencv.cpp: In function ‘void draw_detections_cv_v3(void**, detection*, int, float, char**, image**, int, int)’:
./src/image_opencv.cpp:946:23: warning: variable ‘rgb’ set but not used [-Wunused-but-set-variable]
                float rgb[3];
                      ^~~
./src/image_opencv.cpp: In function ‘void draw_train_loss(char*, void**, int, float, float, int, int, float, int, char*, floa
./src/image_opencv.cpp:1147:13: warning: this ‘if’ clause does not guard... [-Wmisleading-indentation]
            if (iteration_old == 0)
            ^~
./src/image_opencv.cpp:1150:10: note: ...this statement, but the latter is misleadingly indented as if it were guarded by the
         if (iteration_old != 0){
         ^~
./src/image_opencv.cpp: In function ‘void cv_draw_object(image, float*, int, int, int*, float*, int*, int, char**)’:
./src/image_opencv.cpp:1444:14: warning: unused variable ‘buff’ [-Wunused-variable]
        char buff[100];
             ^~~~
./src/image_opencv.cpp:1420:9: warning: unused variable ‘it_tb_res’ [-Wunused-variable]
     int it_tb_res = cv::createTrackbar(it_trackbar_name, window_name, &it_trackbar_value, 1000);
         ^~~~~~~~~
./src/image_opencv.cpp:1424:9: warning: unused variable ‘lr_tb_res’ [-Wunused-variable]
     int lr_tb_res = cv::createTrackbar(lr_trackbar_name, window_name, &lr_trackbar_value, 20);
         ^~~~~~~~~
./src/image_opencv.cpp:1428:9: warning: unused variable ‘cl_tb_res’ [-Wunused-variable]
     int cl_tb_res = cv::createTrackbar(cl_trackbar_name, window_name, &cl_trackbar_value, classes-1);
         ^~~~~~~~~
./src/image_opencv.cpp:1431:9: warning: unused variable ‘bo_tb_res’ [-Wunused-variable]
     int bo_tb_res = cv::createTrackbar(bo_trackbar_name, window_name, boxonly, 1);
         ^~~~~~~~~
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags opencv4 2> /dev/null || pkg-config
./src/http_stream.cpp: In member function ‘bool JSON_sender::write(const char*)’:
./src/http_stream.cpp:253:21: warning: unused variable ‘n’ [-Wunused-variable]
                int n = _write(client, outputbuf, outlen);
                    ^
./src/http_stream.cpp: In member function ‘bool MJPG_sender::write(const cv::Mat&)’:
./src/http_stream.cpp:511:113: warning: format ‘%zu’ expects argument of type ‘size_t’, but argument 3 has type ‘int’ [-Wform
                sprintf(head, "--mjpegstream\r\nContent-Type: image/jpeg\r\nContent-Length: %zu\r\n\r\n", outlen);
                                                                                                            ^
./src/http_stream.cpp: In function ‘void set_track_id(detection*, int, float, float, float, int, int, int)’:
./src/http_stream.cpp:867:27: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
        for (int i = 0; i < v.size(); ++i) {
```

```
                          ~~^~~~~~~~~~
./src/http_stream.cpp:875:33: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
     for (int old_id = 0; old_id < old_dets.size(); ++old_id) {
                          ~~~~~~~^~~~~~~~~~~~~~~~~
./src/http_stream.cpp:894:31: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
     for (int index = 0; index < new_dets_num*old_dets.size(); ++index) {
                         ~~~~~~^~~~~~~~~~~~~~~~~~~~~~~~~~~~~
./src/http_stream.cpp:930:28: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
     if (old_dets_dq.size() > deque_size) old_dets_dq.pop_front();
         ~~~~~~~~~~~~~~~~~~~^~~~~~~~~~~~
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags opencv4 2> /dev/null || pkg-config --cflags opencv` -DGPU
./src/gemm.c: In function ‘convolution_2d’:
./src/gemm.c:2044:15: warning: unused variable ‘out_w’ [-Wunused-variable]
```

Model Mimarisi

```
# nesne algılamalarını gerçekleştirmek için darknet fonksiyonlarını içe aktarma
from darknet import *
# kendi oluşturduğumuz YOLOv4 mimarisini entegre etme
network, class_names, class_colors = load_network("/content/darknet/helmet_yolov4.cfg", "/content/darknet/helmet_data/helmet.data", "
width = network_width(network)
height = network_height(network)

# görüntü üzerinde algılamanın çalışması için darknet yardımcı fonksiyonlarını kullanma
def darknet_helper(img, width, height):
  darknet_image = make_image(width, height, 3)
  img_rgb = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
  img_resized = cv2.resize(img_rgb, (width, height),
                           interpolation=cv2.INTER_LINEAR)

  # görüntü oranlarına göre nesnenin etrafına uygun boyutta sınırlayıcı kutu oluşturma
  img_height, img_width, _ = img.shape
  width_ratio = img_width/width
  height_ratio = img_height/height
```

```
  # modeli darknet görüntüleri üzerinde çalıştırarak algılamaları alma
  copy_image_from_bytes(darknet_image, img_resized.tobytes())
  detections = detect_image(network, class_names, darknet_image)
  free_image(darknet_image)
  return detections, width_ratio, height_ratio
```

Test :

Modelimizin ve diğer gerekliliklerinin kurulumunu

```
# darknet içinde bulunan resimlerden biri üzerinde testi çalıştırma
image = cv2.imread("/content/darknet/helmet_data/helmet_images/01.jpg")
detections, width_ratio, height_ratio = darknet_helper(image, width, height)

for label, confidence, bbox in detections:
  left, top, right, bottom = bbox2points(bbox)
  left, top, right, bottom = int(left * width_ratio), int(top * height_ratio), int(right * width_ratio), int(bottom * height_ratio)
  cv2.rectangle(image, (left, top), (right, bottom), class_colors[label], 2)
  cv2.putText(image, "{} [{:.2f}]".format(label, float(confidence)),
                   (left, top - 5), cv2.FONT_HERSHEY_SIMPLEX, 0.5,
                   class_colors[label], 2)
cv2_imshow(image)
```


Helmet [99.76]

Yardımcı Fonksiyonlar

Gelecek adımlarda ihtiyacımız olacak farklı fotoğraf türleri üzerinde convert işlemi yapabilmemiz için gerekli fonksiyonlarımız.

```
# JavaScript nesnesini bir OpenCV görüntüsüne dönüştürme fonksiyonu
def js_to_image(js_reply):
  """
  Params:
          js_reply: JavaScript object containing image from webcam
  Returns:
          img: OpenCV BGR image
  """
  # base64 dizesini görüntüye dönüştürme
  image_bytes = b64decode(js_reply.split(',')[1])
  # baytları numpy dizisine dönüştürme
  jpg_as_np = np.frombuffer(image_bytes, dtype=np.uint8)
  # numpy dizisini OpenCV BGR görüntüsüne dönüştürme
  img = cv2.imdecode(jpg_as_np, flags=1)

  return img

# OpenCV dikdörtgen sınırlayıcı kutu görüntüsünü video akışına yerleştirilecek base64 bayt dizisine dönüştürme fonksiyonu
def bbox_to_bytes(bbox_array):
  """
  Params:
          bbox_array: Numpy array (pixels) containing rectangle to overlay on video stream.
  Returns:
        bytes: Base64 image byte string
  """
  # diziyi PIL görüntüsüne dönüştürme
  bbox_PIL = PIL.Image.fromarray(bbox_array, 'RGBA')
```

```
    iobuf = io.BytesIO()
    # alınacak çıktı için bbox formatını png olarak biçimlendirme
    bbox_PIL.save(iobuf, format='png')
    # alınacak çıktı dizelerini biçimlendirme
    bbox_bytes = '{}'.format((str(b64encode(iobuf.getvalue()), 'utf-8')))

    return bbox_bytes
```

Webcam Videoları Üzerinde Yolov4

```
# Javascript ile web kamerayı girdi olarak kullanarak canlı video akışını düzgün bir şekilde oluşturma
def video_stream():
  js = Javascript('''
    var video;
    var div = null;
    var stream;
    var captureCanvas;
    var imgElement;
    var labelElement;

    var pendingResolve = null;
    var shutdown = false;

    function removeDom() {
       stream.getVideoTracks()[0].stop();
       video.remove();
       div.remove();
       video = null;
       div = null;
       stream = null;
       imgElement = null;
       captureCanvas = null;
       labelElement = null;
    }
```

```
        function onAnimationFrame() {
          if (!shutdown) {
            window.requestAnimationFrame(onAnimationFrame);
          }
          if (pendingResolve) {
            var result = "";
            if (!shutdown) {
              captureCanvas.getContext('2d').drawImage(video, 0, 0, 640, 480);
              result = captureCanvas.toDataURL('image/jpeg', 0.8)
            }
            var lp = pendingResolve;
            pendingResolve = null;
            lp(result);
          }
        }

        async function createDom() {
          if (div !== null) {
            return stream;
          }

          div = document.createElement('div');
          div.style.border = '2px solid black';
          div.style.padding = '3px';
          div.style.width = '100%';
          div.style.maxWidth = '600px';
          document.body.appendChild(div);

          const modelOut = document.createElement('div');
          modelOut.innerHTML = "<span>Status:</span>";
          labelElement = document.createElement('span');
          labelElement.innerText = 'No data';
          labelElement.style.fontWeight = 'bold';
          modelOut.appendChild(labelElement);
          div.appendChild(modelOut);

          video = document.createElement('video');
```

```
      video.style.display = 'block';
      video.width = div.clientWidth - 6;
      video.setAttribute('playsinline', '');
      video.onclick = () => { shutdown = true; };
      stream = await navigator.mediaDevices.getUserMedia(
          {video: { facingMode: "environment"}});
      div.appendChild(video);

      imgElement = document.createElement('img');
      imgElement.style.position = 'absolute';
      imgElement.style.zIndex = 1;
      imgElement.onclick = () => { shutdown = true; };
      div.appendChild(imgElement);

      const instruction = document.createElement('div');
      instruction.innerHTML =
          '<span style="color: red; font-weight: bold;">' +
          'When finished, click here or on the video to stop this demo</span>';
      div.appendChild(instruction);
      instruction.onclick = () => { shutdown = true; };

      video.srcObject = stream;
      await video.play();

      captureCanvas = document.createElement('canvas');
      captureCanvas.width = 640; //video.videoWidth;
      captureCanvas.height = 480; //video.videoHeight;
      window.requestAnimationFrame(onAnimationFrame);

      return stream;
    }
    async function stream_frame(label, imgData) {
      if (shutdown) {
        removeDom();
        shutdown = false;
        return '';
      }
```

```
        var preCreate = Date.now();
        stream = await createDom();

        var preShow = Date.now();
        if (label != "") {
          labelElement.innerHTML = label;
        }

        if (imgData != "") {
          var videoRect = video.getClientRects()[0];
          imgElement.style.top = videoRect.top + "px";
          imgElement.style.left = videoRect.left + "px";
          imgElement.style.width = videoRect.width + "px";
          imgElement.style.height = videoRect.height + "px";
          imgElement.src = imgData;
        }

        var preCapture = Date.now();
        var result = await new Promise(function(resolve, reject) {
          pendingResolve = resolve;
        });
        shutdown = false;

        return {'create': preShow - preCreate,
                'show': preCapture - preShow,
                'capture': Date.now() - preCapture,
                'img': result};
      }
      ''')

    display(js)

  def video_frame(label, bbox):
    data = eval_js('stream_frame("{}", "{}")'.format(label, bbox))
    return data
```

Anlık Nesne Tanıma

```
# web kamerasından video akışını başlatma
video_stream()
# video etiketi
label_html = 'Capturing...'
# sınırlama kutusunu boşaltma
bbox = ''
count = 0
while True:
    js_reply = video_frame(label_html, bbox)
    if not js_reply:
        break

    # JS yanıtlarını OpenCV görüntüsüne dönüştürme
    frame = js_to_image(js_reply["img"])

    # sınırlayıcı kutu üzerindeki işaretlemeyi biçimlendirme
    bbox_array = np.zeros([480,640,4], dtype=np.uint8)

    # video karesi için oluşturduğumuz darknet yardımcısını çağırma
    detections, width_ratio, height_ratio = darknet_helper(frame, width, height)

    # algılanan nesneleri döngü içerisine alıp bounding box ile işaretleme
    for label, confidence, bbox in detections:
      left, top, right, bottom = bbox2points(bbox)
      left, top, right, bottom = int(left * width_ratio), int(top * height_ratio), int(right * width_ratio), int(bottom * height_rati
      bbox_array = cv2.rectangle(bbox_array, (left, top), (right, bottom), class_colors[label], 2)
      bbox_array = cv2.putText(bbox_array, "{} [{:.2f}]".format(label, float(confidence)),
                       (left, top - 5), cv2.FONT_HERSHEY_SIMPLEX, 0.5,
                       class_colors[label], 2)

    bbox_array[:,:,3] = (bbox_array.max(axis = 2) > 0 ).astype(int) * 255
    # bboxları baytlara dönüştürme
```

```
    bbox_bytes = bbox_to_bytes(bbox_array)
    # bboxları güncelleyerek her bir yeni karede yeni işaretleme yapma
    bbox = bbox_bytes
```