Detectia automata a obiectelor in imagini la indemana oricui

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Sesiune practica de detectie a obiectelor din imagini folosing YOLO vesriunea 3 in implementarea DarkNet

Jupyter

Jupyter este un mediu de programare/executie interactiva care permite scrierea si executia interactiva a liniilor de program pastrand in acelasi timp variabilele in sesiune.

Jupyter permite progrmarea in trei limbaje de programare de tip scripting: JUlia PYthon, R

Instructiunile si rezultatul executiei lor sunt grupate in fisiere care au extensia ipynb si care pot fi rulate doar intr-un mediu de executie jupyter.

Un notebook este compus din doua tipuri de "celule"

- celule de tip text, care nu se executa dar se afiseaza. In celulele de tip text se poate folosi markdown pentru formatare.
- celule de tip cod, care se executa intr-un interpretor python .

Celule de cod

```
print('python in jupyter')
```

```
python in jupyter
```

```
a = 200
b = 223
c = a + b
print(c)
```

```
423
```

Continutul variabilelor se pastreaza de la o celula la alta

```
print(b)
print(a)
```

```
223
200
```

Modulele importate intr-una dintre celule (presupunand ca aeasta este rulata si nu doar scrisa) raman incarcate in memorie. Acestea trebuie importate in notebook inainte de apelarea metodelor acestora. Daca incercam, de exemplu, sa executam metoda randrange a modulului random:

```
print(random.randrange(10))
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-4-552cbbecea43> in <cell line: 1>()
----> 1 print(random.randrange(10))

NameError: name 'random' is not defined
```

obtinem o eroare. Daca importam modulul inainte de executia functiei:

```
import random
print(random.randrange(10))
```

```
8
```

executia este reusita. Odata importat, modulul ramane disponibil pentru celelalte celule.

```
print(random.randrange(10))
```

```
9
```

Notebookurile sunt rulate de un mediu special de executie care este pornit pe un sistem de operare. Odata pornit, mediul Jupyter permite doua tipuri de interactiuni cu sistemul de operare din spate.

- comenzi magice - implementate in motorul de executie jupyter, precedate de semnul %. Comenzile magice depinde de implementarea jupyter.

- redirectare catre consola - orice comanda precedata de semnul exclamarii

Exista comenzi de sistem implementate sub forma de comenzi magice, de exemplu %pwd, %ls,

Pentru a vedea lista comenzilor magice definite in interpooretorul jupyter utilizat, folositi comanda %lsmagic.

```
%lsmagic
```

```
{"cell":
{"!":"OSMagics","HTML":"Other","SVG":"Other","bash":"Other","bigquery"
:"Other","capture":"ExecutionMagics","debug":"ExecutionMagics","file":
"Other","html":"DisplayMagics","javascript":"DisplayMagics","js":"Disp
layMagics","latex":"DisplayMagics","markdown":"DisplayMagics","perl":"
```

```
Other","prun":"ExecutionMagics","pypy":"Other","python":"Other","pytho
n2":"Other","python3":"Other","ruby":"Other","script":"ScriptMagics","
sh":"Other","shell":"Other","svg":"DisplayMagics","sx":"OSMagics","sys
tem":"OSMagics","time":"ExecutionMagics","timeit":"ExecutionMagics","w
ritefile":"OSMagics"},"line":
{"alias":"OSMagics","alias_magic":"BasicMagics","autoawait":"AsyncMagi
cs","autocall":"AutoMagics","automagic":"AutoMagics","autosave":"Kerne
lMagics","bookmark":"OSMagics","cat":"Other","cd":"OSMagics","clear":"
KernelMagics","colors":"BasicMagics","conda":"PackagingMagics","config
":"ConfigMagics","connect_info":"KernelMagics","cp":"Other","debug":"E
xecutionMagics","dhist":"OSMagics","dirs":"OSMagics","doctest_mode":"B
asicMagics","ed":"Other","edit":"KernelMagics","env":"OSMagics","gui":
"BasicMagics","hist":"Other","history":"HistoryMagics","killbgscripts"
:"ScriptMagics","ldir":"Other","less":"KernelMagics","lf":"Other","lk"
:"Other","ll":"Other","load":"CodeMagics","load_ext":"ExtensionMagics"
,"loadpy":"CodeMagics","logoff":"LoggingMagics","logon":"LoggingMagics
","logstart":"LoggingMagics","logstate":"LoggingMagics","logstop":"Log
gingMagics","ls":"Other","lsmagic":"BasicMagics","lx":"Other","macro":
"ExecutionMagics","magic":"BasicMagics","man":"KernelMagics","matplotl
ib":"PylabMagics","mkdir":"Other","more":"KernelMagics","mv":"Other","
notebook":"BasicMagics","page":"BasicMagics","pastebin":"CodeMagics","
pdb":"ExecutionMagics","pdef":"NamespaceMagics","pdoc":"NamespaceMagic
s","pfile":"NamespaceMagics","pinfo":"NamespaceMagics","pinfo2":"Names
paceMagics","pip":"Other","popd":"OSMagics","pprint":"BasicMagics","pr
ecision":"BasicMagics","prun":"ExecutionMagics","psearch":"NamespaceMa
gics","psource":"NamespaceMagics","pushd":"OSMagics","pwd":"OSMagics",
"pycat":"OSMagics","pylab":"PylabMagics","qtconsole":"KernelMagics","q
uickref":"BasicMagics","recall":"HistoryMagics","rehashx":"OSMagics","
reload_ext":"ExtensionMagics","rep":"Other","rerun":"HistoryMagics","r
eset":"NamespaceMagics","reset_selective":"NamespaceMagics","rm":"Othe
r","rmdir":"Other","run":"ExecutionMagics","save":"CodeMagics","sc":"O
SMagics","set_env":"OSMagics","shell":"Other","store":"StoreMagics","s
x":"OSMagics","system":"OSMagics","tb":"ExecutionMagics","tensorflow_v
ersion":"Other","time":"ExecutionMagics","timeit":"ExecutionMagics","u
nalias":"OSMagics","unload_ext":"ExtensionMagics","who":"NamespaceMagi
cs","who_ls":"NamespaceMagics","whos":"NamespaceMagics","xdel":"Namesp
aceMagics","xmode":"BasicMagics"}}
```


Daca vedeti textul "Automagic is ON" puteti utiliza comenzile magice direct, fara a le preceda cu %. Acest lucru scade insa portabilitatea notebookului - mediile care nu au aceasta setare nu il vor putea executa.

Google Colab

Google colab (prescurtarea de la Google collaboratory) este un mediu de rulare a notebookurilor de tip jupyter integrat cu google drive care permite utilizarea placilor video pentru executia calculelor.

Google colab permite rularea codului python din notebookuri stocate in google drive si interactiunea cu directoare din google drive, ceea ce il face un instrument extrem de util pentru testarea codului.

Prin interactiunea cu sistemul de operare, putem rula si programe care nu sunt facute in Python.

Ne propunem sa construim un notebook care sa analizeze imagini stocate in google drive si sa trimita rezultatele detectiei inapoi in google drive, pentru persistenta.

Masina virtuala care asigura executia notebookului se va sterge la finalizare si informatiile se vor pierde.

Conectarea cu google drive (procedura autentificata)

Implementarea jupyter in google collab are un director de lucru numit /content. Alte implementari pot avea alte directoare. Pentru a evita problemele de permisiuni vom lucra in directorul /content si vom monta google drive in /content/gdrive

```
from google.colab import drive,output

drive.mount('/content/gdrive', force_remount=True)
```

```
Mounted at /content/gdrive
```

Analiza automata a imaginilor

Detectia automata a imaginilor are in general trei nivele de precizie.

- Clasificarea imaginilor - imagini care contin un singur obiect si care acopera in foarte mare masura suprafata imaginii
- Detectia obiectelor - identificarea limitelor si pozitiei obiectelor (posibil multiple) in imagine
- Segmentarea semantica - fiecare pixel al imaginii este etichetat.

```
from IPython.display import Image as DImage
DImage(filename='/content/gdrive/My Drive/Personal/Facultate Informatica/2024-scoala_de_vara/resources/analiza_imagine.jpg', width=1000)
```

YOLO si Darknet

You Only Look Once este una dintre primele metode de detectare a obiectelor in imagini. Implementarea pe care o vom folosi este scrisa in C++ si se numeste darknet .

Verificam mountul corect prin testarea unuia dintre directoare.

```
!ls /content/gdrive/MyDrive/Personal/Facultate\ Informatica/2024-scoala_de_vara/images/test_images
```

```
berze_detect.jpg  bike.jpg    bucuresti_detect.jpg  house.jpg      snow.jpg
berze.jpg    blur_detect.jpg  bucuresti.jpg  masini_detect.jpg
bike_detect.jpg   blur.jpg    horse.jpg           masini.jpg.jpeg
```

Pentru Runtime tip GPU

```
import os
print(os.environ['PATH'])
if '/usr/local/cuda/bin' not in os.environ['PATH'].split(os.pathsep):
  os.environ['PATH'] += ':/usr/local/cuda/bin'
  print('adding cuda binaries to path')
else:
  print('cuda binaries in path')
```

```
/opt/bin:/usr/local/nvidia/bin:/usr/local/cuda/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/tools/node/bin:/tools/google-cloud-sdk/bin
cuda binaries in path
```

```
!cd /content
!pwd
```

```
/content
```

Folosim comanda git (deja instalata) pentru a prelua codul darknet din repositoty-ul github

```
!git clone https://github.com/AlexeyAB/darknet
```

```
Cloning into 'darknet'...
remote: Enumerating objects: 15851, done.ote: Counting objects: 100% (18/18), done.ote: Compressing objects: 100% (14/14), done.ote: Total 15851 (delta 5), reused 13 (delta 4), pack-reused 15833
```

Verificam

```
%cd /content/darknet/
!pwd
!ls
```

```
/content/darknet
/content/darknet
3rdparty   DarknetConfig.cmake.in     Dockerfile.cpu         LICENSE
           scripts
build      darknet_images.py     Dockerfile.gpu         Makefile
src
build.ps1  darknet.py       image_yolov3.sh        net_cam_v3.sh
vcpkg.json
cfg        darknet_video.py image_yolov4.sh        net_cam_v4.sh
vcpkg.json.opencv23
cmake      data              include                package.xml
video_yolov3.sh
CMakeLists.txt   docker-compose.yml    json_mjpeg_streams.sh  README.md
video_yolov4.sh
```

programul darknet va trebui compilat. Pentru aceasta va trebui sa rulam comanda make dar inainte de a o face vom folosi sed pentru a seta anumite caracteristici pe care ne dorim ca sistemul compilat sa le aiba. Sa inspectam primele linii din makefile unde sunt aceste optiuni

```
!head Makefile

GPU=0
CUDNN=0
CUDNN_HALF=0
OPENCV=0
AVX=0
OPENMP=0
LIBSO=0
ZED_CAMERA=0
ZED_CAMERA_v2_8=0
```

Dorim sa compilam cu GPU=1 daca suntem intr-un runtime cu GPU, dorim sa compilam cu OPENCV=1 pentru a adauga o serie de capacitati suplimentare de manipulare a imaginilor si dorim sa compilam cu LIBSO=1 pentru a obtine o biblioteca dinamica care ne va permite apelarea darknetului direct din codul Python.

Pentru runtime de tip gpu

```
!sed -i 's/GPU=0/GPU=1/g' Makefile
```

Pentru orice runtime

```
!sed -i 's/OPENCV=0/OPENCV=1/g' Makefile

!sed -i 's/LIBISO=0/LOBISO=1/g' Makefile

!head Makefile
```

```
GPU=0
CUDNN=0
CUDNN_HALF=0
OPENCV=1
AVX=0
OPENMP=0
LIBSO=1
ZED_CAMERA=0
ZED_CAMERA_v2_8=0


!make

mkdir -p ./obj/
mkdir -p backup
mkdir -p results
chmod +x *.sh
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -DOPENCV
`pkg-config --cflags opencv4 2> /dev/null || pkg-config --cflags
opencv` -Wall -Wfatal-errors -Wno-unused-result -Wno-unknown-pragmas -
fPIC -rdynamic -Ofast -DOPENCV -fPIC -c ./src/image_opencv.cpp -o
obj/image_opencv.o
age_opencv.cpp:age**, int, int)age_opencv.cpp:945:23:l#index-Wunused-
but-set-variable-Wunused-but-set-variable]8;;age_opencv.cpp:age,
float*, int, int, int*, float*, int*, int,
char**)age_opencv.cpp:1443:14:l#index-Wunused-variable-Wunused-
variable]8;;age_opencv.cpp:1419:9:l#index-Wunused-variable-Wunused-
variable]8;;e, window_name, &it_trackbar_value, 1000);
      |         age_opencv.cpp:1423:9:l#index-Wunused-variable-
Wunused-variable]8;;e, window_name, &lr_trackbar_value, 20);
      |         age_opencv.cpp:1427:9:l#index-Wunused-variable-
Wunused-variable]8;;e, window_name, &cl_trackbar_value, classes-1);
      |         age_opencv.cpp:1430:9:l#index-Wunused-variable-
Wunused-variable]8;;e, window_name, boxonly, 1);
      |         age_opencv.cpp:age_opencv.cpp:449:14:age, int, int,
int)l#index-Wunused-function-Wunused-function]8;;age m, int x, int y,
int c)
      |              as -fPIC -rdynamic -Ofast -DOPENCV -fPIC -c
./src/http_stream.cpp -o obj/http_stream.o
.cpp:ember function ‘.cpp:253:21:l#index-Wunused-variable-Wunused-
variable]8;;.cpp:.cpp:866:27:parison of integer expressions of
different signedness: ‘l#index-Wsign-compare-Wsign-
compare]8;;.cpp:874:33:parison of integer expressions of different
signedness: ‘l#index-Wsign-compare-Wsign-
compare]8;;.cpp:893:31:parison of integer expressions of different
signedness: ‘l#index-Wsign-compare-Wsign-
compare]8;;*old_dets.size().cpp:929:28:parison of integer expressions
of different signedness: ‘l#index-Wsign-compare-Wsign-compare]8;;as -
fPIC -rdynamic -Ofast -DOPENCV -fPIC -c ./src/gemm.c -o obj/gemm.o
m.c:m.c:2042:15:l#index-Wunused-variable-Wunused-
```

```
variable]8;;m.c:2041:15:l#index-Wunused-variable-Wunused-
variable]8;;as -fPIC -rdynamic -Ofast -DOPENCV -fPIC -c ./src/utils.c
-o obj/utils.o
_hashent used as truth value [l#index-Wparentheses-Wparentheses]8;;
‘ent [l#index-Wstringop-truncation-Wstringop-truncation]8;;puted here
  563 |     strncpy(copy, s, as -fPIC -rdynamic -Ofast -DOPENCV -fPIC
-c ./src/dark_cuda.c -o obj/dark_cuda.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/convolutional_layer.c -o
obj/convolutional_layer.o
l#index-Wunused-variable-Wunused-variable]8;;l#index-Wunused-variable-
Wunused-variable]8;;l#index-Wunused-variable-Wunused-variable]8;;as -
fPIC -rdynamic -Ofast -DOPENCV -fPIC -c ./src/list.c -o obj/list.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/image.c -o obj/image.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/activations.c -o obj/activations.o
eration value ‘l#index-Wswitch-Wswitch]8;;eration value ‘l#index-
Wswitch-Wswitch]8;;eration value ‘l#index-Wswitch-Wswitch]8;;eration
value ‘l#index-Wswitch-Wswitch]8;;eration value ‘l#index-Wswitch-
Wswitch]8;;eration value ‘l#index-Wswitch-Wswitch]8;;eration value
‘l#index-Wswitch-Wswitch]8;;eration value ‘l#index-Wswitch-
Wswitch]8;;eration value ‘l#index-Wswitch-Wswitch]8;;eration value
‘l#index-Wswitch-Wswitch]8;;as -fPIC -rdynamic -Ofast -DOPENCV -fPIC -
c ./src/im2col.c -o obj/im2col.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/col2im.c -o obj/col2im.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/blas.c -o obj/blas.o
ultilayer_cpul#index-Wunused-variable-Wunused-variable]8;;as -fPIC -
rdynamic -Ofast -DOPENCV -fPIC -c ./src/crop_layer.c -o
obj/crop_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/dropout_layer.c -o obj/dropout_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
```

```
-DOPENCV -fPIC -c ./src/maxpool_layer.c -o obj/maxpool_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/softmax_layer.c -o obj/softmax_layer.o
ax_layer.c:ax_layer.c:242:27:ax_truthl#index-Wunused-but-set-variable-
Wunused-but-set-variable]8;;ax_truthas -fPIC -rdynamic -Ofast -DOPENCV
-fPIC -c ./src/data.c -o obj/data.o
l#index-Wunused-variable-Wunused-variable]8;;l#index-Wunused-but-set-
variable-Wunused-but-set-variable]8;;l#index-Wformat-overflow=-
Wformat-overflow=]8;;ing directive output of 8 bytes
  431 |             sprintf(buff,     t,l#index-Wformat-overflow=-
Wformat-overflow=]8;;ing directive output of 8 bytes
  437 |             sprintf(buff,     t,l#index-Wformat-overflow=-
Wformat-overflow=]8;;ing directive output of 8 bytes
  424 |             sprintf(buff, ing directive output of 8 bytes
In file included from    t,l#index-Wformat-overflow=-Wformat-
overflow=]8;;    t,l#index-Wformat-overflow=-Wformat-overflow=]8;; 0
to %d]\" >> bad_label.list",     t,as -fPIC -rdynamic -Ofast -DOPENCV
-fPIC -c ./src/matrix.c -o obj/matrix.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/network.c -o obj/network.o
a_periodl#index-Wunused-variable-Wunused-
variable]8;;a_periodax_batches - ema_start_point - 1000) * (1.0 -
net.ema_alpha);
      |             l#index-Wunused-function-Wunused-function]8;;as -
fPIC -rdynamic -Ofast -DOPENCV -fPIC -c ./src/connected_layer.c -o
obj/connected_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/cost_layer.c -o obj/cost_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/parser.c -o obj/parser.o
plicit_weightsl#index-Wunused-variable-Wunused-
variable]8;;ultipliersent 1 range [18446744071562067968,
18446744073709551615] exceeds maximum object size 9223372036854775807
[l#index-Walloc-size-larger-than=-Walloc-size-larger-
than=]8;;ultipliers = (float *) emb, size_t __size)
      |              as -fPIC -rdynamic -Ofast -DOPENCV -fPIC -c
./src/option_list.c -o obj/option_list.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/darknet.c -o obj/darknet.o
```

```
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/detection_layer.c -o obj/detection_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/captcha.c -o obj/captcha.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/route_layer.c -o obj/route_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/writing.c -o obj/writing.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/box.c -o obj/box.o
eration value ‘l#index-Wswitch-Wswitch]8;;s_sortl#index-Wunused-
variable-Wunused-variable]8;;_prob;
      |                              l#index-Wunused-variable-Wunused-
variable]8;;_prob;
      |                              as -fPIC -rdynamic -Ofast -DOPENCV -
fPIC -c ./src/nightmare.c -o obj/nightmare.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/normalization_layer.c -o
obj/normalization_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/avgpool_layer.c -o obj/avgpool_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/coco.c -o obj/coco.o
l#index-Wunused-variable-Wunused-variable]8;;p4_det_test_";
      |           as -fPIC -rdynamic -Ofast -DOPENCV -fPIC -c
./src/dice.c -o obj/dice.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/yolo.c -o obj/yolo.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
```

```
-DOPENCV -fPIC -c ./src/detector.c -o obj/detector.o
inate_bddent with no effect [l#index-Wunused-value-Wunused-
value]8;;kd2l#index-Wunused-variable-Wunused-
variable]8;;kd2ake_directory(buff2, 0777);
      |             kdl#index-Wunused-variable-Wunused-
variable]8;;kdake_directory(buff, 0777);
      |             apl#index-Wunused-but-set-variable-Wunused-but-
set-variable]8;;l#index-Wunused-variable-Wunused-variable]8;;l#index-
Wunused-variable-Wunused-variable]8;;age_idl#index-Wunused-function-
Wunused-function]8;;age_ide)
      |            as -fPIC -rdynamic -Ofast -DOPENCV -fPIC -c
./src/layer.c -o obj/layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/compare.c -o obj/compare.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/classifier.c -o obj/classifier.o
l#index-Wunused-variable-Wunused-variable]8;;el#index-Wunused-
variable-Wunused-variable]8;;eo_classifierl#index-Wunused-variable-
Wunused-variable]8;;eval tval_before, tval_after, l#index-Wunused-
variable-Wunused-variable]8;;eval tval_before, as -fPIC -rdynamic -
Ofast -DOPENCV -fPIC -c ./src/local_layer.c -o obj/local_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/swag.c -o obj/swag.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/shortcut_layer.c -o obj/shortcut_layer.o
ake_shortcut_layerl#index-Wunused-variable-Wunused-variable]8;;as -
fPIC -rdynamic -Ofast -DOPENCV -fPIC -c ./src/representation_layer.c -
o obj/representation_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/activation_layer.c -o obj/activation_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/rnn_layer.c -o obj/rnn_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/gru_layer.c -o obj/gru_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
```

```
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/rnn.c -o obj/rnn.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/rnn_vid.c -o obj/rnn_vid.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/crnn_layer.c -o obj/crnn_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/demo.c -o obj/demo.o
o.c:o.c:100:15:l#index-Wunused-variable-Wunused-variable]8;;as -fPIC -
rdynamic -Ofast -DOPENCV -fPIC -c ./src/tag.c -o obj/tag.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/cifar.c -o obj/cifar.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/go.c -o obj/go.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/batchnorm_layer.c -o obj/batchnorm_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/art.c -o obj/art.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/region_layer.c -o obj/region_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/reorg_layer.c -o obj/reorg_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/reorg_old_layer.c -o obj/reorg_old_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/super.c -o obj/super.o
```

```
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/voxel.c -o obj/voxel.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/tree.c -o obj/tree.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/yolo_layer.c -o obj/yolo_layer.o
atch_tl#index-Wunused-but-set-variable-Wunused-but-set-
variable]8;;atch_tl#index-Wunused-variable-Wunused-
variable]8;;l#index-Wunused-variable-Wunused-variable]8;;l#index-
Wunused-variable-Wunused-variable]8;;l#index-Wunused-variable-Wunused-
variable]8;;l#index-Wunused-variable-Wunused-variable]8;;l#index-
Wunused-variable-Wunused-variable]8;;l#index-Wunused-variable-Wunused-
variable]8;;l#index-Wunused-variable-Wunused-variable]8;;l#index-
Wunused-variable-Wunused-variable]8;;l#index-Wunused-variable-Wunused-
variable]8;;as -fPIC -rdynamic -Ofast -DOPENCV -fPIC -c
./src/gaussian_yolo_layer.c -o obj/gaussian_yolo_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/upsample_layer.c -o obj/upsample_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/lstm_layer.c -o obj/lstm_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/conv_lstm_layer.c -o obj/conv_lstm_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/scale_channels_layer.c -o
obj/scale_channels_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags
opencv4 2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-
errors -Wno-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast
-DOPENCV -fPIC -c ./src/sam_layer.c -o obj/sam_layer.o
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -DOPENCV
`pkg-config --cflags opencv4 2> /dev/null || pkg-config --cflags
opencv` -Wall -Wfatal-errors -Wno-unused-result -Wno-unknown-pragmas -
fPIC -rdynamic -Ofast -DOPENCV -fPIC obj/image_opencv.o
obj/http_stream.o obj/gemm.o obj/utils.o obj/dark_cuda.o
obj/convolutional_layer.o obj/list.o obj/image.o obj/activations.o
```

```
obj/im2col.o obj/col2im.o obj/blas.o obj/crop_layer.o
obj/dropout_layer.o obj/maxpool_layer.o obj/softmax_layer.o obj/data.o
obj/matrix.o obj/network.o obj/connected_layer.o obj/cost_layer.o
obj/parser.o obj/option_list.o obj/darknet.o obj/detection_layer.o
obj/captcha.o obj/route_layer.o obj/writing.o obj/box.o
obj/nightmare.o obj/normalization_layer.o obj/avgpool_layer.o
obj/coco.o obj/dice.o obj/yolo.o obj/detector.o obj/layer.o
obj/compare.o obj/classifier.o obj/local_layer.o obj/swag.o
obj/shortcut_layer.o obj/representation_layer.o obj/activation_layer.o
obj/rnn_layer.o obj/gru_layer.o obj/rnn.o obj/rnn_vid.o
obj/crnn_layer.o obj/demo.o obj/tag.o obj/cifar.o obj/go.o
obj/batchnorm_layer.o obj/art.o obj/region_layer.o obj/reorg_layer.o
obj/reorg_old_layer.o obj/super.o obj/voxel.o obj/tree.o
obj/yolo_layer.o obj/gaussian_yolo_layer.o obj/upsample_layer.o
obj/lstm_layer.o obj/conv_lstm_layer.o obj/scale_channels_layer.o
obj/sam_layer.o -o darknet -lm -pthread `pkg-config --libs opencv4
2> /dev/null || pkg-config --libs opencv`
g++ -std=c++11 -shared -std=c++11 -fvisibility=hidden -DLIB_EXPORTS -
Iinclude/ -I3rdparty/stb/include -DOPENCV `pkg-config --cflags opencv4
2> /dev/null || pkg-config --cflags opencv` -Wall -Wfatal-errors -Wno-
unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast -DOPENCV -
fPIC ./obj/image_opencv.o ./obj/http_stream.o ./obj/gemm.o
./obj/utils.o ./obj/dark_cuda.o ./obj/convolutional_layer.o
./obj/list.o ./obj/image.o ./obj/activations.o ./obj/im2col.o
./obj/col2im.o ./obj/blas.o ./obj/crop_layer.o
./obj/dropout_layer.o ./obj/maxpool_layer.o ./obj/softmax_layer.o
./obj/data.o ./obj/matrix.o ./obj/network.o
./obj/connected_layer.o ./obj/cost_layer.o ./obj/parser.o
./obj/option_list.o ./obj/darknet.o ./obj/detection_layer.o
./obj/captcha.o ./obj/route_layer.o ./obj/writing.o ./obj/box.o
./obj/nightmare.o ./obj/normalization_layer.o
./obj/avgpool_layer.o ./obj/coco.o ./obj/dice.o ./obj/yolo.o
./obj/detector.o ./obj/layer.o ./obj/compare.o ./obj/classifier.o
./obj/local_layer.o ./obj/swag.o ./obj/shortcut_layer.o
./obj/representation_layer.o ./obj/activation_layer.o
./obj/rnn_layer.o ./obj/gru_layer.o ./obj/rnn.o ./obj/rnn_vid.o
./obj/crnn_layer.o ./obj/demo.o ./obj/tag.o ./obj/cifar.o
./obj/go.o ./obj/batchnorm_layer.o ./obj/art.o
./obj/region_layer.o ./obj/reorg_layer.o ./obj/reorg_old_layer.o
./obj/super.o ./obj/voxel.o ./obj/tree.o ./obj/yolo_layer.o
./obj/gaussian_yolo_layer.o ./obj/upsample_layer.o
./obj/lstm_layer.o ./obj/conv_lstm_layer.o
./obj/scale_channels_layer.o ./obj/sam_layer.o src/yolo_v2_class.cpp -
o libdarknet.so -lm -pthread `pkg-config --libs opencv4 2> /dev/null
|| pkg-config --libs opencv`
In file included from ember function ‘an_t::clear_old_states()parison
of integer expressions of different signedness: ‘l#index-Wsign-
compare-Wsign-compare]8;;g_size.width) ||
parison of integer expressions of different signedness: ‘l#index-
```

```
Wsign-compare-Wsign-compare]8;;g_size.height))
ember function ‘an_t::tst_t track_kalman_t::get_state_id(bbox_t,
std::vector<bool>&)parison of integer expressions of different
signedness: ‘l#index-Wsign-compare-Wsign-compare]8;;ax_objectsember
function ‘an_t::predict()parison of integer expressions of different
signedness: ‘l#index-Wsign-compare-Wsign-compare]8;;ax_objectsember
function ‘an_t::correct(std::vector<bbox_t>)parison of integer
expressions of different signedness: ‘l#index-Wsign-compare-Wsign-
compare]8;;ax_objectsember function ‘parison of integer expressions of
different signedness: ‘l#index-Wsign-compare-Wsign-
compare]8;;es_storyparison of integer expressions of different
signedness: ‘l#index-Wsign-compare-Wsign-compare]8;;ax_dist] >
cur_dist)) {
      |                          parison of integer expressions of
different signedness: ‘l#index-Wsign-compare-Wsign-
compare]8;;es_storyas -fPIC -rdynamic -Ofast -DOPENCV -fPIC -o uselib
src/yolo_console_dll.cpp -lm -pthread `pkg-config --libs opencv4 2>
/dev/null || pkg-config --libs opencv` -L ./ -l:libdarknet.so
In file included from ember function ‘an_t::clear_old_states()parison
of integer expressions of different signedness: ‘l#index-Wsign-
compare-Wsign-compare]8;;g_size.width) ||
parison of integer expressions of different signedness: ‘l#index-
Wsign-compare-Wsign-compare]8;;g_size.height))
ember function ‘an_t::tst_t track_kalman_t::get_state_id(bbox_t,
std::vector<bool>&)parison of integer expressions of different
signedness: ‘l#index-Wsign-compare-Wsign-compare]8;;ax_objectsember
function ‘an_t::predict()parison of integer expressions of different
signedness: ‘l#index-Wsign-compare-Wsign-compare]8;;ax_objectsember
function ‘an_t::correct(std::vector<bbox_t>)parison of integer
expressions of different signedness: ‘l#index-Wsign-compare-Wsign-
compare]8;;ax_objectsparison of integer expressions of different
signedness: ‘l#index-Wsign-compare-Wsign-compare]8;;ax_width =
(parison of integer expressions of different signedness: ‘l#index-
Wsign-compare-Wsign-compare]8;;ax_width_3d = (l#index-Wunused-
variable-Wunused-variable]8;;
```

Verificari

```
!ls -all darknet

-rwxr-xr-x 1 root root 1578320 Jun 24 20:43 darknet

!ls -all libdarknet.so

-rwxr-xr-x 1 root root 1668568 Jun 24 20:43 libdarknet.so
```

Descarcarea ponderilor preantrenate

Nu facem antrenament (desi darknet permite aceasta) ci doar detectie. Pentru aceasta avem nevoie de datele modelului.

```
!wget https://pjreddie.com/media/files/yolov3.weights
```

```
--2024-06-24 20:46:02--
https://pjreddie.com/media/files/yolov3.weights
Resolving pjreddie.com (pjreddie.com)... 162.0.215.52
Connecting to pjreddie.com (pjreddie.com)|162.0.215.52|:443...
connected.
HTTP request sent, awaiting response... 200 OK
Length: 248007048 (237M) [application/octet-stream]
Saving to: ‘yolov3.weights’

yolov3.weights      100%[===================>] 236.52M  18.4MB/s    in
14s

2024-06-24 20:46:16 (17.3 MB/s) - ‘yolov3.weights’ saved
[248007048/248007048]
```

Detectia obiectelor in imagini

Revedem lista imaginilor de test pe care le avem:

```
!ls /content/gdrive/MyDrive/Personal/Facultate\ Informatica/2024-
scoala_de_vara/images/test_images
```

```
berze_detect.jpg  bike.jpg    bucuresti_detect.jpg  house.jpg
snow.jpg
berze.jpg    blur_detect.jpg  bucuresti.jpg  masini_detect.jpg
bike_detect.jpg   blur.jpg    horse.jpg           masini.jpg.jpeg
```

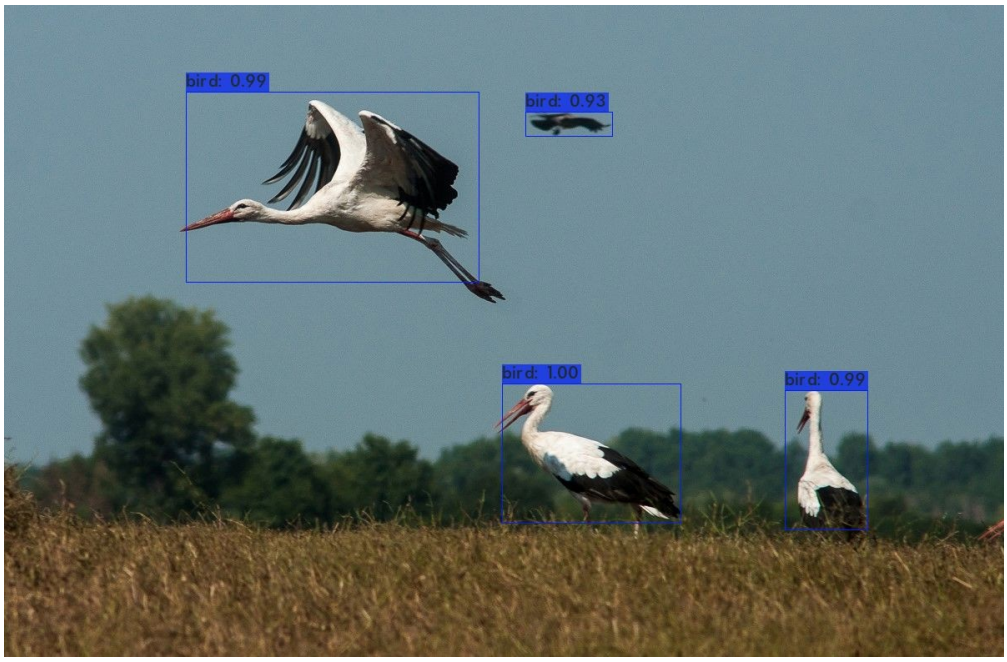
Folosim Image din IPython display pentru a afisa imagini

```
DImage(filename='/content/gdrive/My Drive/Personal/Facultate
Informatica/2024-scoala_de_vara/images/test_images/berze.jpg',
width=400)
```

Rulam darknet pe prima imagine

```
!./darknet detect cfg/yolov3.cfg yolov3.weights /content/gdrive/My\
Drive/Personal/Facultate\ Informatica/2024-
scoala_de_vara/images/test_images/berze.jpg

DImage(filename='predictions.jpg', width=500)
```



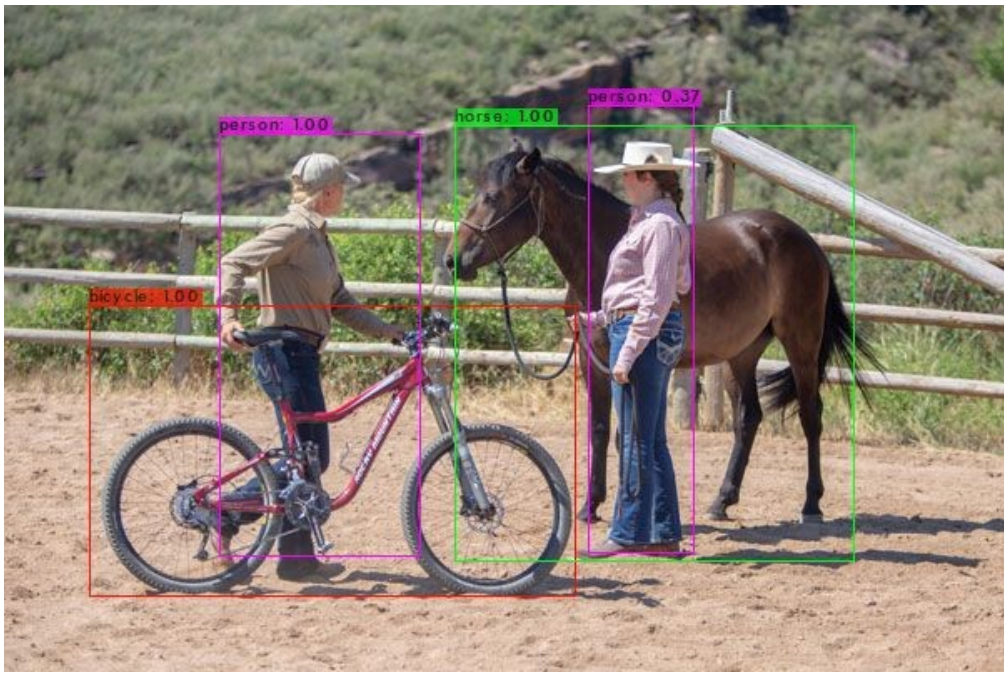

```
!cp predictions.jpg /content/gdrive/My\ Drive/Personal/Facultate\
Informatica/2024-scoala_de_vara/images/test_images/berze_detect.jpg
```

bike.jpg

```
DImage(filename='/content/gdrive/My Drive/Personal/Facultate
Informatica/2024-scoala_de_vara/images/test_images/bike.jpg',
width=400)
```

```
!./darknet detect cfg/yolov3.cfg yolov3.weights /content/gdrive/My\
Drive/Personal/Facultate\ Informatica/2024-
scoala_de_vara/images/test_images/bike.jpg

DImage(filename='predictions.jpg', width=500)
```



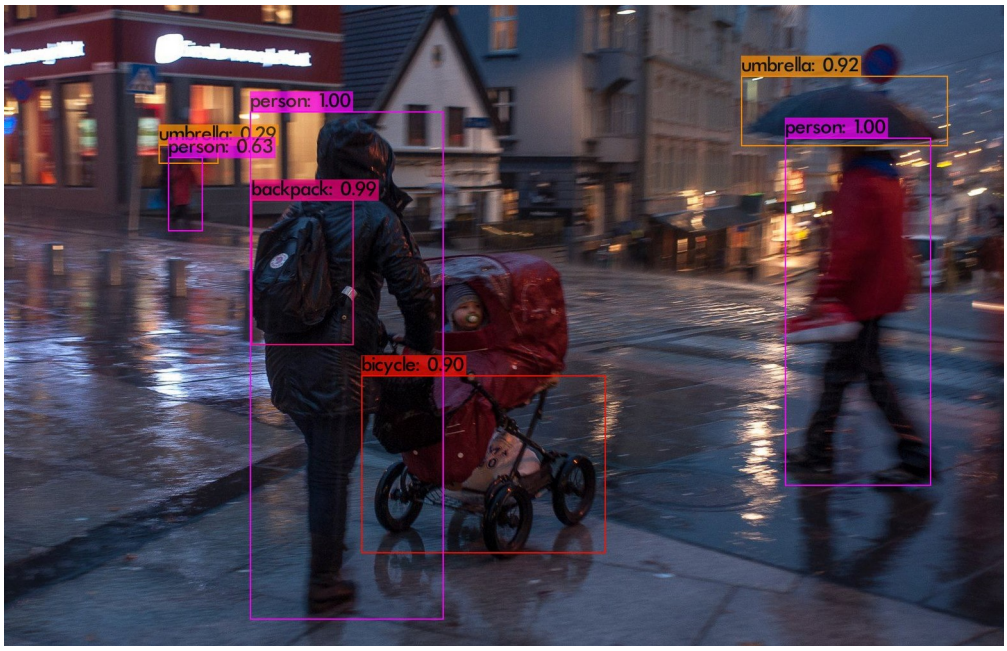
```
!cp predictions.jpg /content/gdrive/My\ Drive/Personal/Facultate\
Informatica/2024-scoala_de_vara/images/test_images/bike_detect.jpg
```

blur.jpg

```
DImage(filename='/content/gdrive/My Drive/Personal/Facultate
Informatica/2024-scoala_de_vara/images/test_images/blur.jpg',
width=400)
```

```
!./darknet detect cfg/yolov3.cfg yolov3.weights /content/gdrive/My\
Drive/Personal/Facultate\ Informatica/2024-
scoala_de_vara/images/test_images/blur.jpg

DImage(filename='predictions.jpg', width=500)
```



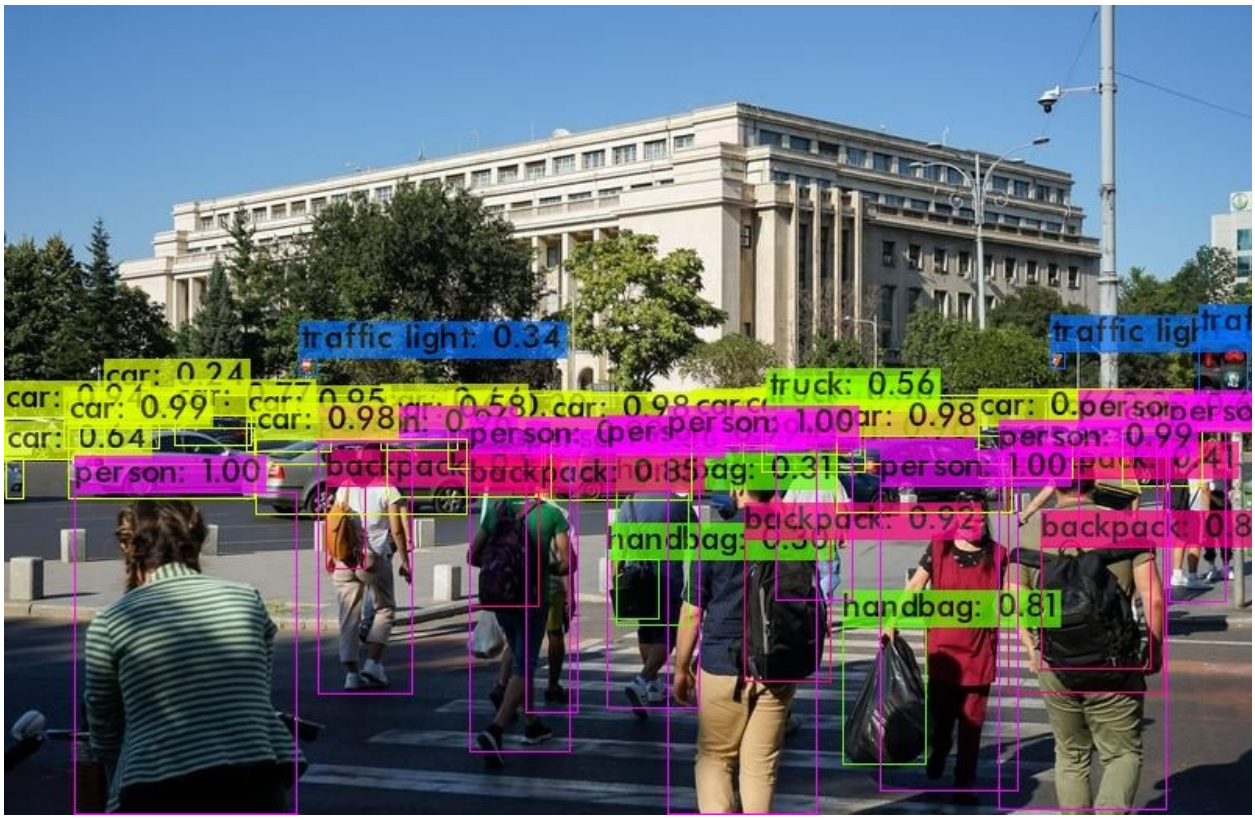
```
!cp predictions.jpg /content/gdrive/My\ Drive/Personal/Facultate\
Informatica/2024-scoala_de_vara/images/test_images/blur_detect.jpg
```

bucuresti

```
DImage(filename='/content/gdrive/My Drive/Personal/Facultate
Informatica/2024-scoala_de_vara/images/test_images/bucuresti.jpg',
width=400)
```

```
!./darknet detect cfg/yolov3.cfg yolov3.weights /content/gdrive/My\
Drive/Personal/Facultate\ Informatica/2024-
scoala_de_vara/images/test_images/bucuresti.jpg

DImage(filename='predictions.jpg', width=800)
```




```
!cp predictions.jpg /content/gdrive/My\ Drive/Personal/Facultate\
Informatica/2024-scoala_de_vara/images/test_images/bucuresti_detect.jp
g
```

masini

```
DImage(filename='/content/gdrive/My Drive/Personal/Facultate
Informatica/2024-scoala_de_vara/images/test_images/masini.jpg.jpeg',
width=600)
```

```
!./darknet detect cfg/yolov3.cfg yolov3.weights /content/gdrive/My\
Drive/Personal/Facultate\ Informatica/2024-
scoala_de_vara/images/test_images/masini.jpg.jpeg

DImage(filename='predictions.jpg', width=800)
```

```
!cp predictions.jpg /content/gdrive/My\ Drive/Personal/Facultate\
Informatica/2024-scoala_de_vara/images/test_images/masini_detect.jpg
```

Detectia obiectelor in materiale video

Pentru manipularea materialelor video avem nevoie de o serie de librarii si pachete software noi. Pentru a instala aceste pachete trebuie sa stim ce fel de distributie Linux avem la dispozitie. In cele mai multe distributii moderne aceasta se face prin inspectarea fisierului /etc/os-release

```
cat /etc/os-release

PRETTY_NAME="Ubuntu 22.04.3 LTS"
NAME="Ubuntu"
VERSION_ID="22.04"
VERSION="22.04.3 LTS (Jammy Jellyfish)"
VERSION_CODENAME=jammy
ID=ubuntu
ID_LIKE=debian
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/
privacy-policy"
UBUNTU_CODENAME=jammy
```

Observam ca suntem pe o distributie de tip Ubuntu, ceea ce inseamna ca putem folosi sistemul de pachete apt

```
!apt install ffmpeg libopencv-dev libgtk-3-dev python3-numpy libjpeg-
dev libtiff5-dev libavcodec-dev libavformat-dev libswscale-dev
libxine2-dev libgstreamer1.0-dev libgstreamer-plugins-base1.0-dev
libv4l-dev libtbb-dev qtbase5-dev libfaac-dev libmp3lame-dev
libopencore-amrnb-dev libopencore-amrwb-dev libtheora-dev libvorbis-
dev libxvidcore-dev x264 v4l-utils unzip
```

Rularea darknet pe un material video

```
!./darknet detector demo cfg/coco.data cfg/yolov3.cfg yolov3.weights -
thresh 0.20 -dont_show /content/gdrive/My\ Drive/Personal/Facultate\
Informatica/2024-scoala_de_vara/videos/pigalle.mp4 -out_filename
/content/gdrive/My\ Drive/Personal/Facultate\ Informatica/2024-
scoala_de_vara/videos/pigalle_res.mp4 >res
```

Jupyter nu permite observarea directa a materialelor video asa ca rezultatul detectiei fisierului video va trebui observat direct in google drive.

Exista posibilitatea afisarii materialelor video in notebookuri folosing cod HTML dar pentru aceasta este necesar ca fisierul video sa fie disponibil la un anumit URL.

Apelarea din python

Operatiile de detectie de pana acum au fost executate prin lansarea unul fisier executabil compilat care are o serie de optiuni limitate si care face foarte dificila o interactiune mai granulara cu datele de detectie.

Darknet ofera si un modul python care permite apelarea functiilor bibliotecii direct din notebook. Pentru aceasta, inainte de orice altceva, trebuie sa modificam modulul darknet.py care nu este conceput sa fie incarcat in jupyter.

Daca inspectam fragmentul dintre liniile 257 - 269 din fisierul darknet.py

```
!sed -n '257,269p' darknet.py
```

```
if os.name == "posix":
    cwd = os.path.dirname(__file__)
    lib = ct.CDLL(cwd + "/libdarknet.so", ct.RTLD_GLOBAL)
elif os.name == "nt":
    cwd = os.path.dirname(__file__)
    os.environ["PATH"] = os.path.pathsep.join((cwd,
os.environ["PATH"]))
    lib = ct.CDLL("darknet.dll", winmode = 0, mode = ct.RTLD_GLOBAL)
else:
    lib = None  # Intellisense
    print("Unsupported OS")
    exit()
```

Observam existenta metodei __file__

Jupyter nu suporta __file__ (executia nu este directa) asa ca trebuie sa inlocuim __file__ cu calea reala.

```
!sed -i "s@cwd\s+\s@'/content/darknet' + @g" darknet.py
```

Importam modulele principale, inclusiv darknet

```
import os
import sys
import glob
import random
import time
import cv2
import ctypes as ct
import numpy as np
import darknet
```

configurarea retelei

Apelarea din python a functiei modulului incepe prin instructiunile de configurare a retelei neuronale.

```
random.seed(3)  # deterministic bbox colors

network, class_names, class_colors =
darknet.load_network('cfg/yolov3.cfg','cfg/coco.data','yolov3.weights'
, batch_size=1)
```

Functia de detectie

```
def image_detection(image_or_path, network, class_names, class_colors,
thresh):
    # Darknet doesn't accept numpy images.
    # Create one with image we reuse for each detect

    width = darknet.network_width(network)
    height = darknet.network_height(network)
    darknet_image = darknet.make_image(width, height, 3)

    if isinstance(image_or_path, str):
        image = cv2.imread(image_or_path)
    else:
        image = image_or_path
    image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
    image_resized = cv2.resize(image_rgb, (width, height),
                               interpolation=cv2.INTER_LINEAR)

    darknet.copy_image_from_bytes(darknet_image,
image_resized.tobytes())
    detections = darknet.detect_image(network, class_names,
darknet_image, thresh=thresh)
    darknet.free_image(darknet_image)
    image = darknet.draw_boxes(detections, image_resized,
class_colors)
    return cv2.cvtColor(image, cv2.COLOR_BGR2RGB), detections
```

Detectia propriu-zisa

```
image,detections = image_detection('/content/gdrive/My
Drive/Personal/Facultate
Informatica/2024-scoala_de_vara/images/test_images/berze.jpg',
network, class_names, class_colors, 0.25)

print(detections)
```

```
[('bird', '94.41', (234.87315368652344, 76.13102722167969,
36.139095306396484, 14.960158348083496)), ('bird', '98.88',
```

```
(136.82415771484375, 116.2491455078125, 120.9631576538086,
122.23291778564453)), ('bird', '99.08', (341.95452880859375,
290.69580078125, 34.24788284301758, 88.5368423461914)), ('bird',
'99.87', (244.40924072265625, 286.2257385253906, 74.57611083984375,
88.47339630126953))]

image_library_dir = '/content/gdrive/My Drive/Personal/Facultate
Informatica/2024-scoala_de_vara/all_images'
```

Avand acces direct la lista de obiecte detectate in fiecare imagine, putem analiza de-odata o cantitate mare de fisiere si putem obtine o statistica a obiectelor identificate.

```
def get_detection_stats(directory):
      print('detection stats', flush=True)
      image_extensions = ('.jpg', '.jpeg', '.png', '.bmp', '.gif')
      all_files = [os.path.join(directory, file) for file in
os.listdir(directory) if file.lower().endswith(image_extensions)]
      print(f'detecting {len(all_files)}', flush=True)
      random.seed(3)  # deterministic bbox colors
      network, class_names, class_colors =
darknet.load_network('cfg/yolov3.cfg','cfg/coco.data','yolov3.weights'
, batch_size=1)
      detection_stats = {}
      total_images = len(all_files)
      for idx, image_path in enumerate(all_files, start=1):
        image, detections = image_detection(image_path, network,
class_names, class_colors, 0.5)
        for detection in detections:
            label = detection[0]
            if label in detection_stats:
                detection_stats[label] += 1
            else:
                detection_stats[label] = 1
        print(f"{idx} of {total_images} detected", end='\r',
flush=True)
      print("Detection Statistics:")
      for label, count in detection_stats.items():
        print(f"{label}: {count}")

get_detection_stats(image_library_dir)
```

```
435 of 435 detected Detection Statistics:
car: 128
person: 546
dog: 14
boat: 56
skis: 2
bird: 37
bottle: 2
cat: 24
```

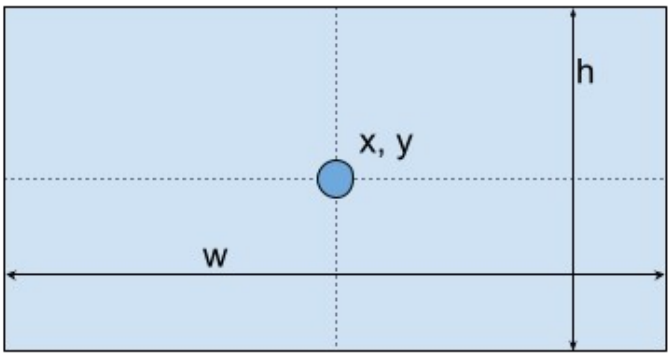
```
chair: 19
truck: 12
handbag: 6
diningtable: 2
cup: 6
wine glass: 2
pottedplant: 15
bear: 3
bench: 10
bus: 3
carrot: 1
orange: 2
bed: 4
bicycle: 9
horse: 15
apple: 1
sheep: 64
keyboard: 1
stop sign: 1
vase: 2
cow: 10
umbrella: 13
elephant: 1
surfboard: 3
book: 3
motorbike: 3
traffic light: 1
clock: 1
toilet: 1
sports ball: 1
tennis racket: 1
kite: 1
tie: 1
```

Distribuirea imaginilor in subdirectoare in functie de categoria lor

Apeland functia de detectie din perl vom obtine o lista a tuturor obiectelor detectate. Coordonatele acestora trebuie convertite la valorile reale ale imaginilor pentru a fi desenate pe imagine. Coordonatele returnate de functia de detectie sunt in numar de 4: coordonatele x si y ale centrului casetei si dimensiunea casetei (latinea si inaltimea). Valorile sunt relative la dimensiunea operationala a retelei neuronale care este 416 x 416

Pentru a desena casetele de detectie coorconatele acestora trebuie reconvertite, asa cum se vede in imaginea urmatoare:

```
DImage(filename='/content/gdrive/My Drive/Personal/Facultate Informatica/2024-scoala_de_vara/resources/bbox.png', width=600)
```



Caseta de detectie: x, y, w, h

x_{min} = int(round(x - (w / 2)))
x_{max} = int(round(x + (w / 2)))
y_{min} = int(round(y - (h / 2)))
y_{max} = int(round(y + (h / 2)))

```
import shutil
from PIL import Image, ImageDraw
import numpy as np
from tqdm import tqdm

def convert_back(x, y, w, h):
    xmin = int(round(x - (w / 2)))
    xmax = int(round(x + (w / 2)))
    ymin = int(round(y - (h / 2)))
    ymax = int(round(y + (h / 2)))
    return xmin, ymin, xmax, ymax


def copy_detected_images_with_boxes(directory, target_directory):
      image_extensions = ('.jpg', '.jpeg', '.png', '.bmp', '.gif')
      all_files = [os.path.join(directory, file) for file in
os.listdir(directory) if file.lower().endswith(image_extensions)]

      network, class_names, class_colors =
darknet.load_network('cfg/yolov3.cfg','cfg/coco.data','yolov3.weights'
, batch_size=1)
      detection_stats = {}
      total_images = len(all_files)
      pbar = tqdm(total=total_images)
      for idx, image_path in enumerate(all_files, start=1):
        pbar.update(1)
        image, detections = image_detection(image_path, network,
class_names, class_colors, 0.3)
        iheight, iwidth, _ = image.shape
        detected_classes = set(detection[0] for detection in
detections)
        for label, confidence, bbox in detections:

          for target_class in detected_classes:
            filtered_detections = [d for d in detections if d[0] ==
target_class]
            if filtered_detections:
               drimage = Image.open(image_path)
```

```
                draw = ImageDraw.Draw(drimage)
                original_width, original_height = drimage.size

                for label, confidence, bbox in filtered_detections:

                    x, y, w, h = bbox
                    x = (x / darknet.network_width(network)) *
original_width
                    w = (w / darknet.network_width(network)) *
original_width
                    y = (y / darknet.network_height(network)) *
original_height
                    h = (h / darknet.network_height(network)) *
original_height

                    xmin, ymin, xmax, ymax = convert_back(float(x),
float(y), float(w), float(h))
                    draw.rectangle([xmin, ymin, xmax, ymax],
outline="red", width=3)
                    draw.text((xmin, ymin), f"{label} [{confidence}]",
fill="red")

                    label_directory = os.path.join(target_directory,
label)
                    if not os.path.exists(label_directory):
                      os.makedirs(label_directory)

                    destination_path = os.path.join(label_directory,
os.path.basename(image_path))
                    drimage.save(destination_path)

copy_detected_images_with_boxes(image_library_dir,image_library_dir)

 34%|███       | 146/435 [35:05<59:36, 12.38s/it]

---------------------------------------------------------------------
-----
KeyboardInterrupt                         Traceback (most recent call
last)
<ipython-input-85-988bba2f13a8> in <cell line: 1>()
----> 1
copy_detected_images_with_boxes(image_library_dir,image_library_dir)

<ipython-input-84-909b0ff7351d> in
copy_detected_images_with_boxes(directory, target_directory)
     24       for idx, image_path in enumerate(all_files, start=1):
     25         pbar.update(1)
---> 26         image, detections = image_detection(image_path,
network, class_names, class_colors, 0.3)
     27         iheight, iwidth, _ = image.shape
     28         detected_classes = set(detection[0] for detection in
```

```
detections)

<ipython-input-58-27a1decfc6a6> in image_detection(image_or_path,
network, class_names, class_colors, thresh)
     16
     17     darknet.copy_image_from_bytes(darknet_image,
image_resized.tobytes())
---> 18     detections = darknet.detect_image(network, class_names,
darknet_image, thresh=thresh)
     19     darknet.free_image(darknet_image)
     20     image = darknet.draw_boxes(detections, image_resized,
class_colors)

/content/darknet/darknet.py in detect_image(network, class_names,
image, thresh, hier_thresh, nms)
    244     """
    245     pnum = ct.pointer(ct.c_int(0))
--> 246     predict_image(network, image)
    247     detections = get_network_boxes(network, image.w, image.h,
    248                                    thresh, hier_thresh, None,
0, pnum, 0)

KeyboardInterrupt:
```

La capatul executiei acestui cod vom obtine o serie de subdirectoare suplimentare in care se vor copia imaginile in care au fost detectate obiecte.