Yolo를 활용한 객체 인식

학습 내용

- yolo3를 설치 후, 이를 활용한 객체 인식을 수행해 봅니다.

목차

01 사전 준비 - 설치, 환경 설정

목차로 이동하기

- OpenCV: 객체 인식 및 이미지 처리를 위한 라이브러리로 설치가 필요

In [4]:
```
# OpenCV 설치
!pip install opencv-python
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/
public/simple/
Requirement already satisfied: opencv-python in /usr/local/lib/python3.10/dist-packa
ges (4.7.0.72)
Requirement already satisfied: numpy>=1.21.2 in /usr/local/lib/python3.10/dist-packa
ges (from opencv-python) (1.22.4)
```

- Darknet: YOLO 프레임워크로서, 객체 인식을 수행하기 위해 설치가 필요

In [6]:
```
# !git clone https://github.com/AlexeyAB/darknet.git
# !git clone https://github.com/pjreddie/darknet
```

In [10]:
```
# darknet 파일 확인
!cd darknet/; ls; make
```

```
3rdparty              data                    README.md
build                 Deer_un.jpeg            results
build.ps1             image_yolov3.sh         scripts
cfg                   image_yolov4.sh         src
cmake                 include                 vcpkg.json
CMakeLists.txt        json_mjpeg_streams.sh   vcpkg.json.opencv23
DarknetConfig.cmake.in LICENSE                video_yolov3.sh
darknet_images.py     Makefile                video_yolov4.sh
darknet.py            net_cam_v3.sh
darknet_video.py      net_cam_v4.sh
mkdir -p ./obj/
mkdir -p backup
chmod +x *.sh
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wn
o-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast -c ./src/image_opencv.cp
p -o obj/image_opencv.o
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wn
o-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast -c ./src/http_stream.cpp
-o obj/http_stream.o
./src/http_stream.cpp: In member function 'bool JSON_sender::write(const ch
ar*)':
./src/http_stream.cpp:253:21: warning: unused variable 'n' [-Wunused-varia
ble]
  253 |            int n = _write(client, outputbuf, outlen);
      |                ^
./src/http_stream.cpp: In function 'void set_track_id(detection*, int, flo
at, float, float, int, int, int)':
./src/http_stream.cpp:867:27: warning: comparison of integer expressions of di
fferent signedness: 'int' and 'std::vector<detection_t>::size_type' {aka
'long unsigned int' } [-Wsign-compare]
  867 |       for (int i = 0; i < v.size(); ++i) {
      |                       ~~^~~~~~~~~~~
./src/http_stream.cpp:875:33: warning: comparison of integer expressions of di
fferent signedness: 'int' and 'std::vector<detection_t>::size_type' {aka
'long unsigned int' } [-Wsign-compare]
  875 |     for (int old_id = 0; old_id < old_dets.size(); ++old_id) {
      |                          ~~~~~~~^~~~~~~~~~~~~~~~~~
./src/http_stream.cpp:894:31: warning: comparison of integer expressions of di
fferent signedness: 'int' and 'std::vector<detection_t>::size_type' {aka
'long unsigned int' } [-Wsign-compare]
  894 |     for (int index = 0; index < new_dets_num*old_dets.size(); ++index)
 {
      |                         ~~~~~~^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
./src/http_stream.cpp:930:28: warning: comparison of integer expressions of di
fferent signedness: 'std::deque<std::vector<detection_t> >::size_type' {aka
'long unsigned int' } and 'int' [-Wsign-compare]
  930 |     if (old_dets_dq.size() > deque_size) old_dets_dq.pop_front();
      |         ~~~~~~~~~~~~~~~~~~~^~~~~~~~~~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/gemm.c -o obj/gemm.o
./src/gemm.c: In function 'convolution_2d':
./src/gemm.c:2044:15: warning: unused variable 'out_w' [-Wunused-variable]
 2044 |     const int out_w = (w + 2 * pad - ksize) / stride + 1;    // output_widt
h=input_width for stride=1 and pad=1
      |               ^~~~~
./src/gemm.c:2043:15: warning: unused variable 'out_h' [-Wunused-variable]
 2043 |     const int out_h = (h + 2 * pad - ksize) / stride + 1;    // output_heig
ht=input_height for stride=1 and pad=1
      |               ^~~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/utils.c -o obj/utils.o
./src/utils.c: In function 'custom_hash':
./src/utils.c:1082:12: warning: suggest parentheses around assignment used as t
ruth value [-Wparentheses]
 1082 |     while (c = *str++)
```

```
        |                 ^
In file included from /usr/include/string.h:495,
                 from include/darknet.h:14,
                 from ./src/utils.h:3,
                 from ./src/utils.c:4:
In function 'strncpy',
    inlined from 'copy_string' at ./src/utils.c:552:5:
/usr/include/x86_64-linux-gnu/bits/string_fortified.h:106:10: warning: '_
_builtin_strncpy' specified bound depends on the length of the source argument [
-Wstringop-overflow=]
  106 |   return __builtin___strncpy_chk (__dest, __src, __len, __bos (__de
st));
      |          ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~
./src/utils.c: In function 'copy_string':
./src/utils.c:552:22: note: length computed here
  552 |     strncpy(copy, s, strlen(s)+1);
      |                      ^~~~~~~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/dark_cuda.c -o obj/dark_cuda.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/convolutional_layer.c -o obj/convolut
ional_layer.o
./src/convolutional_layer.c: In function 'resize_convolutional_layer':
./src/convolutional_layer.c:898:9: warning: unused variable 'old_h' [-Wunu
sed-variable]
  898 |     int old_h = l->h;
      |         ^~~~~
./src/convolutional_layer.c:897:9: warning: unused variable 'old_w' [-Wunu
sed-variable]
  897 |     int old_w = l->w;
      |         ^~~~~
./src/convolutional_layer.c: In function 'forward_convolutional_layer':
./src/convolutional_layer.c:1342:32: warning: unused variable 't_intput_siz
e' [-Wunused-variable]
 1342 |                 size_t t_intput_size = binary_transpose_align_inpu
t(k, n, state.workspace, &l.t_bit_input, ldb_align, l.bit_align);
      |                        ^~~~~~~~~~~~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/list.c -o obj/list.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/image.c -o obj/image.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/activations.c -o obj/activations.o
./src/activations.c: In function 'activate':
./src/activations.c:79:5: warning: enumeration value 'RELU6' not handled in
 switch [-Wswitch]
   79 |     switch(a){
      |     ^~~~~~
./src/activations.c:79:5: warning: enumeration value 'SWISH' not handled in
 switch [-Wswitch]
./src/activations.c:79:5: warning: enumeration value 'MISH' not handled in s
witch [-Wswitch]
./src/activations.c:79:5: warning: enumeration value 'HARD_MISH' not handled
in switch [-Wswitch]
./src/activations.c:79:5: warning: enumeration value 'NORM_CHAN' not handled
in switch [-Wswitch]
./src/activations.c:79:5: warning: enumeration value 'NORM_CHAN_SOFTMAX' no
t handled in switch [-Wswitch]
./src/activations.c:79:5: warning: enumeration value 'NORM_CHAN_SOFTMAX_MAX
VAL' not handled in switch [-Wswitch]
./src/activations.c: In function 'gradient':
./src/activations.c:310:5: warning: enumeration value 'SWISH' not handled in
switch [-Wswitch]
  310 |     switch(a){
```

```
          |     ^~~~~~
./src/activations.c:310:5: warning: enumeration value 'MISH' not handled in
 switch [-Wswitch]
./src/activations.c:310:5: warning: enumeration value 'HARD_MISH' not handle
d in switch [-Wswitch]
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/im2col.c -o obj/im2col.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/col2im.c -o obj/col2im.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/blas.c -o obj/blas.o
./src/blas.c: In function 'backward_shortcut_multilayer_cpu':
./src/blas.c:207:21: warning: unused variable 'out_index' [-Wunused-variab
le]
  207 |             int out_index = id;
      |                 ^~~~~~~~~
./src/blas.c: In function 'find_sim':
./src/blas.c:597:59: warning: format '%d' expects argument of type 'int', b
ut argument 2 has type 'size_t' {aka 'long unsigned int'} [-Wformat=]
  597 |        printf(" Error: find_sim(): sim isn't found: i = %d, j = %d, z = %d
 \n", i, j, z);
      |                                              ~^
~
      |                                               |
|
      |                                               int
size_t {aka long unsigned int}
      |                                              %ld
./src/blas.c:597:67: warning: format '%d' expects argument of type 'int', b
ut argument 3 has type 'size_t' {aka 'long unsigned int'} [-Wformat=]
  597 |        printf(" Error: find_sim(): sim isn't found: i = %d, j = %d, z = %d
 \n", i, j, z);
      |                                                     ~^
~
      |                                                      |
|
      |                                                      int
size_t {aka long unsigned int}
      |                                                     %ld
./src/blas.c:597:75: warning: format '%d' expects argument of type 'int', b
ut argument 4 has type 'size_t' {aka 'long unsigned int'} [-Wformat=]
  597 |        printf(" Error: find_sim(): sim isn't found: i = %d, j = %d, z = %d
 \n", i, j, z);
      |                                                            ~^
~
      |                                                             |
|
      |                                                             in
t        size_t {aka long unsigned int}
      |                                                            %ld
./src/blas.c: In function 'find_P_constrastive':
./src/blas.c:611:68: warning: format '%d' expects argument of type 'int', b
ut argument 2 has type 'size_t' {aka 'long unsigned int'} [-Wformat=]
  611 |        printf(" Error: find_P_constrastive(): P isn't found: i = %d, j = %
d, z = %d \n", i, j, z);
      |                                                       ~^
~
      |                                                        |
|
      |                                                        int
size_t {aka long unsigned int}
      |                                                       %ld
./src/blas.c:611:76: warning: format '%d' expects argument of type 'int', b
ut argument 3 has type 'size_t' {aka 'long unsigned int'} [-Wformat=]
  611 |        printf(" Error: find_P_constrastive(): P isn't found: i = %d, j = %d
```

```
, z = %d \n", i, j, z);
       |                                                ~^
~
       |                                                |
|
       |                                                i
nt              size_t {aka long unsigned int}
       |                                                %l
d
./src/blas.c:611:84: warning: format '%d' expects argument of type 'int', b
ut argument 4 has type 'size_t' {aka 'long unsigned int'} [-Wformat=]
  611 |         printf(" Error: find_P_constrastive(): P isn't found: i = %d, j = %
d, z = %d \n", i, j, z);
       |                |
~^            ~
       |                |
|           |
       |                |
int          size_t {aka long unsigned int}
       |                |
%ld
./src/blas.c: In function 'P_constrastive_f':
./src/blas.c:651:79: warning: format '%d' expects argument of type 'int', b
ut argument 3 has type 'size_t' {aka 'long unsigned int'} [-Wformat=]
  651 |         fprintf(stderr, " Error: in P_constrastive must be i != l, while i =
%d, l = %d \n", i, l);
       |                |
~^            ~
       |                |
|           |
       |                |
int          size_t {aka long unsigned int}
       |                |
%ld
./src/blas.c:651:87: warning: format '%d' expects argument of type 'int', b
ut argument 4 has type 'size_t' {aka 'long unsigned int'} [-Wformat=]
  651 |         fprintf(stderr, " Error: in P_constrastive must be i != l, while i =
%d, l = %d \n", i, l);
       |                |
~^         ~
       |                |
|        |
       |                |
int      size_t {aka long unsigned int}
       |                |
%ld
./src/blas.c: In function 'P_constrastive':
./src/blas.c:785:79: warning: format '%d' expects argument of type 'int', b
ut argument 3 has type 'size_t' {aka 'long unsigned int'} [-Wformat=]
  785 |         fprintf(stderr, " Error: in P_constrastive must be i != l, while i =
%d, l = %d \n", i, l);
       |                |
~^              ~
       |                |
|           |
       |                |
int          size_t {aka long unsigned int}
       |                |
%ld
./src/blas.c:785:87: warning: format '%d' expects argument of type 'int', b
ut argument 4 has type 'size_t' {aka 'long unsigned int'} [-Wformat=]
  785 |         fprintf(stderr, " Error: in P_constrastive must be i != l, while i =
%d, l = %d \n", i, l);
       |                |
~^          ~
```

```
        |
|       |
        |
int     size_t {aka long unsigned int}
        |
%ld
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/crop_layer.c -o obj/crop_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/dropout_layer.c -o obj/dropout_layer.
o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/maxpool_layer.c -o obj/maxpool_layer.
o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/softmax_layer.c -o obj/softmax_layer.
o
./src/softmax_layer.c: In function 'make_contrastive_layer':
./src/softmax_layer.c:203:101: warning: format '%d' expects argument of type
 'int', but argument 9 has type 'size_t' {aka 'const long unsigned int'} [
-Wformat=]
  203 |     fprintf(stderr, "contrastive %4d x%4d x%4d x emb_size %4d x batch: %4d
 classes = %4d, step = %4d \n", w, h, l.n, l.embedding_size, batch, l.classes, step
);
      |
~~^                                                          ~~~~
      |
|                                                            |
      |
int                                                          size_t {aka const long unsign
ed int}
      |
%4ld
./src/softmax_layer.c: In function 'forward_contrastive_layer':
./src/softmax_layer.c:244:27: warning: variable 'max_truth' set but not use
d [-Wunused-but-set-variable]
  244 |                 float max_truth = 0;
      |                       ^~~~~~~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/data.c -o obj/data.o
./src/data.c: In function 'load_data_detection':
./src/data.c:1409:43: warning: variable 'r_scale' set but not used [-Wunuse
d-but-set-variable]
 1409 |     float r1 = 0, r2 = 0, r3 = 0, r4 = 0, r_scale;
      |                                           ^~~~~~~
./src/data.c: In function 'fill_truth_detection':
./src/data.c:440:33: warning: '%s' directive writing up to 4095 bytes into a
 region of size 251 [-Wformat-overflow=]
  440 |         sprintf(buff, "echo %s \"Wrong annotation: w = %f\" >> bad_labe
l.list", labelpath, w);
      |                                 ^~
~~~~~~~~~
./src/data.c:440:27: note: assuming directive output of 8 bytes
  440 |         sprintf(buff, "echo %s \"Wrong annotation: w = %f\" >> bad
_label.list", labelpath, w);
      |                           ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~~~~~~~
In file included from /usr/include/stdio.h:867,
                 from include/darknet.h:13,
                 from ./src/data.h:5,
                 from ./src/data.c:1:
/usr/include/x86_64-linux-gnu/bits/stdio2.h:36:10: note: '__builtin___spr
intf_chk' output between 52 and 4461 bytes into a destination of size 256
   36 |   return __builtin___sprintf_chk (__s, __USE_FORTIFY_LEVEL - 1,
      |          ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

```
  37 |         __bos (__s), __fmt, __va_arg_pack ());
     |         ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
./src/data.c:447:33: warning: '%s' directive writing up to 4095 bytes into a
 region of size 251 [-Wformat-overflow=]
 447 |         sprintf(buff, "echo %s W"Wrong annotation: h = %fW" >> bad_labe
l.list", labelpath, h);
     |                             ^~
~~~~~~~~~
./src/data.c:447:27: note: assuming directive output of 8 bytes
 447 |         sprintf(buff, "echo %s W"Wrong annotation: h = %fW" >> bad
_label.list", labelpath, h);
     |                           ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~~~~~~~~
In file included from /usr/include/stdio.h:867,
                 from include/darknet.h:13,
                 from ./src/data.h:5,
                 from ./src/data.c:1:
/usr/include/x86_64-linux-gnu/bits/stdio2.h:36:10: note: '__builtin___spr
intf_chk' output between 52 and 4461 bytes into a destination of size 256
  36 |   return __builtin___sprintf_chk (__s, __USE_FORTIFY_LEVEL - 1,
     |          ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
  37 |         __bos (__s), __fmt, __va_arg_pack ());
     |         ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
./src/data.c:432:33: warning: '%s' directive writing up to 4095 bytes into a
 region of size 251 [-Wformat-overflow=]
 432 |         sprintf(buff, "echo %s W"Wrong annotation: x = %f, y = %fW" >> b
ad_label.list", labelpath, x, y);
     |                             ^~
~~~~~~~~~
./src/data.c:432:27: note: assuming directive output of 8 bytes
 432 |         sprintf(buff, "echo %s W"Wrong annotation: x = %f, y = %f
W" >> bad_label.list", labelpath, x, y);
     |                           ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~~~~~~~~~~~~~~~
./src/data.c:432:27: note: assuming directive output of 8 bytes
In file included from /usr/include/stdio.h:867,
                 from include/darknet.h:13,
                 from ./src/data.h:5,
                 from ./src/data.c:1:
/usr/include/x86_64-linux-gnu/bits/stdio2.h:36:10: note: '__builtin___spr
intf_chk' output between 61 and 4784 bytes into a destination of size 256
  36 |   return __builtin___sprintf_chk (__s, __USE_FORTIFY_LEVEL - 1,
     |          ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
  37 |         __bos (__s), __fmt, __va_arg_pack ());
     |         ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
./src/data.c:424:33: warning: '%s' directive writing up to 4095 bytes into a
 region of size 251 [-Wformat-overflow=]
 424 |         sprintf(buff, "echo %s W"Wrong annotation: x = 0 or y = 0W" >> b
ad_label.list", labelpath);
     |                             ^~
~~~~~~~~~
In file included from /usr/include/stdio.h:867,
                 from include/darknet.h:13,
                 from ./src/data.h:5,
                 from ./src/data.c:1:
/usr/include/x86_64-linux-gnu/bits/stdio2.h:36:10: note: '__builtin___spr
intf_chk' output between 59 and 4154 bytes into a destination of size 256
  36 |   return __builtin___sprintf_chk (__s, __USE_FORTIFY_LEVEL - 1,
     |          ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
  37 |         __bos (__s), __fmt, __va_arg_pack ());
     |         ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
./src/data.c:410:33: warning: '%s' directive writing up to 4095 bytes into a
 region of size 251 [-Wformat-overflow=]
 410 |         sprintf(buff, "echo %s W"Wrong annotation: class_id = %d. But cl
ass_id should be [from 0 to %d]W" >> bad_label.list", labelpath, id, (classes-1));
```

```
        |                                          ^~
~~~~~~~~
In file included from /usr/include/stdio.h:867,
                 from include/darknet.h:13,
                 from ./src/data.h:5,
                 from ./src/data.c:1:
/usr/include/x86_64-linux-gnu/bits/stdio2.h:36:10: note:  '__builtin___spr
intf_chk'  output between 95 and 4210 bytes into a destination of size 256
   36 |    return __builtin___sprintf_chk (__s, __USE_FORTIFY_LEVEL - 1,
      |           ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
   37 |          __bos (__s), __fmt, __va_arg_pack ());
      |          ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/matrix.c -o obj/matrix.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/network.c -o obj/network.o
./src/network.c: In function  'train_network_waitkey' :
./src/network.c:435:13: warning: unused variable  'ema_period'  [-Wunused-va
riable]
  435 |        int ema_period = (net.max_batches - ema_start_point - 1000) * (1.0
- net.ema_alpha);
      |            ^~~~~~~~~~
At top level:
./src/network.c:1269:14: warning:  'relu'  defined but not used [-Wunused-fun
ction]
 1269 | static float relu(float src) {
      |              ^~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/connected_layer.c -o obj/connected_la
yer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/cost_layer.c -o obj/cost_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/parser.c -o obj/parser.o
./src/parser.c: In function  'save_implicit_weights' :
./src/parser.c:1909:9: warning: unused variable  'i'  [-Wunused-variable]
 1909 |    int i;
      |        ^
./src/parser.c: In function  'get_classes_multipliers' :
./src/parser.c:438:40: warning: argument 1 range [18446744071562067968, 1844674
4073709551615] exceeds maximum object size 9223372036854775807 [-Walloc-size-larg
er-than=]
  438 |        classes_multipliers = (float *)calloc(classes_counters, sizeof
(float));
      |                                       ^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~~
In file included from ./src/parser.c:3:
/usr/include/stdlib.h:542:14: note: in a call to allocation function  'calloc
'  declared here
  542 | extern void *calloc (size_t __nmemb, size_t __size)
      |              ^~~~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/option_list.c -o obj/option_list.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/darknet.c -o obj/darknet.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/detection_layer.c -o obj/detection_la
yer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/captcha.c -o obj/captcha.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/route_layer.c -o obj/route_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/writing.c -o obj/writing.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
```

```
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/box.c -o obj/box.o
./src/box.c: In function 'box_iou_kind':
./src/box.c:154:5: warning: enumeration value 'MSE' not handled in switch [-W
switch]
  154 |     switch(iou_kind) {
      |     ^~~~~~
./src/box.c: In function 'diounms_sort':
./src/box.c:898:27: warning: unused variable 'beta_prob' [-Wunused-variabl
e]
  898 |                 float beta_prob = pow(dets[j].prob[k], 2) / sum_prob;
      |                       ^~~~~~~~~
./src/box.c:897:27: warning: unused variable 'alpha_prob' [-Wunused-variab
le]
  897 |                 float alpha_prob = pow(dets[i].prob[k], 2) / sum_prob;
      |                       ^~~~~~~~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/nightmare.c -o obj/nightmare.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/normalization_layer.c -o obj/normaliz
ation_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/avgpool_layer.c -o obj/avgpool_layer.
o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/coco.c -o obj/coco.o
./src/coco.c: In function 'validate_coco_recall':
./src/coco.c:248:11: warning: unused variable 'base' [-Wunused-variable]
  248 |     char *base = "results/comp4_det_test_";
      |           ^~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/dice.c -o obj/dice.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/yolo.c -o obj/yolo.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/detector.c -o obj/detector.o
./src/detector.c: In function 'train_detector':
./src/detector.c:395:72: warning: suggest parentheses around '&&' within '||
' [-Wparentheses]
  395 |         (iteration >= (iter_save + 1000) || iteration % 1000 ==
 0) && net.max_batches < 10000)
      |         ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~^~~~~~~~~~~~~~~~~~~~~~~~~
./src/detector.c:328:13: warning: variable 'draw_precision' set but not use
d [-Wunused-but-set-variable]
  328 |         int draw_precision = 0;
      |             ^~~~~~~~~~~~~~
./src/detector.c:67:11: warning: unused variable 'avg_contrastive_acc' [-W
unused-variable]
   67 |     float avg_contrastive_acc = 0;
      |           ^~~~~~~~~~~~~~~~~~~
./src/detector.c: In function 'eliminate_bdd':
./src/detector.c:588:21: warning: statement with no effect [-Wunused-value]
  588 |             for (k; buf[k + n] != '\0'; k++)
      |                  ^~~
./src/detector.c: In function 'validate_detector':
./src/detector.c:709:13: warning: unused variable 'mkd2' [-Wunused-variabl
e]
  709 |         int mkd2 = make_directory(buff2, 0777);
      |             ^~~~
./src/detector.c:707:13: warning: unused variable 'mkd' [-Wunused-variable
]
  707 |         int mkd = make_directory(buff, 0777);
      |             ^~~
./src/detector.c: In function 'validate_detector_map':
./src/detector.c:1326:24: warning: variable 'cur_prob' set but not used [-W
```

```
unused-but-set-variable]
 1326 |                 double cur_prob = 0;
      |                        ^~~~~~~~
./src/detector.c:1347:15: warning: unused variable 'class_recall' [-Wunuse
d-variable]
 1347 |          float class_recall = (float)tp_for_thresh_per_class[i] / ((float)t
p_for_thresh_per_class[i] + (float)(truth_classes_count[i] - tp_for_thresh_per_class
[i]));
      |                ^~~~~~~~~~~~
./src/detector.c:1346:15: warning: unused variable 'class_precision' [-Wun
used-variable]
 1346 |          float class_precision = (float)tp_for_thresh_per_class[i] / ((floa
t)tp_for_thresh_per_class[i] + (float)fp_for_thresh_per_class[i]);
      |                ^~~~~~~~~~~~~~~
At top level:
./src/detector.c:461:12: warning: 'get_coco_image_id' defined but not used
 [-Wunused-function]
  461 | static int get_coco_image_id(char *filename)
      |            ^~~~~~~~~~~~~~~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/layer.c -o obj/layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/compare.c -o obj/compare.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/classifier.c -o obj/classifier.o
./src/classifier.c: In function 'train_classifier':
./src/classifier.c:190:13: warning: variable 'draw_precision' set but not u
sed [-Wunused-but-set-variable]
  190 |          int draw_precision = 0;
      |              ^~~~~~~~~~~~~~
./src/classifier.c:146:9: warning: unused variable 'count' [-Wunused-varia
ble]
  146 |     int count = 0;
      |         ^~~~~
./src/classifier.c:35:11: warning: unused variable 'avg_contrastive_acc' [
-Wunused-variable]
   35 |     float avg_contrastive_acc = 0;
      |           ^~~~~~~~~~~~~~~~~~~
./src/classifier.c: In function 'predict_classifier':
./src/classifier.c:855:13: warning: unused variable 'time' [-Wunused-varia
ble]
  855 |     clock_t time;
      |             ^~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/local_layer.c -o obj/local_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/swag.c -o obj/swag.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/shortcut_layer.c -o obj/shortcut_laye
r.o
./src/shortcut_layer.c: In function 'make_shortcut_layer':
./src/shortcut_layer.c:55:15: warning: unused variable 'scale' [-Wunused-v
ariable]
   55 |          float scale = sqrt(2. / l.nweights);
      |                ^~~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/representation_layer.c -o obj/represe
ntation_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/activation_layer.c -o obj/activation_
layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/rnn_layer.c -o obj/rnn_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/gru_layer.c -o obj/gru_layer.o
```

```
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/rnn.c -o obj/rnn.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/rnn_vid.c -o obj/rnn_vid.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/crnn_layer.c -o obj/crnn_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/demo.c -o obj/demo.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/tag.c -o obj/tag.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/cifar.c -o obj/cifar.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/go.c -o obj/go.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/batchnorm_layer.c -o obj/batchnorm_la
yer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/art.c -o obj/art.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/region_layer.c -o obj/region_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/reorg_layer.c -o obj/reorg_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/reorg_old_layer.c -o obj/reorg_old_la
yer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/super.c -o obj/super.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/voxel.c -o obj/voxel.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/tree.c -o obj/tree.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/yolo_layer.c -o obj/yolo_layer.o
./src/yolo_layer.c: In function 'process_batch':
./src/yolo_layer.c:426:25: warning: variable 'best_match_t' set but not use
d [-Wunused-but-set-variable]
  426 |                     int best_match_t = 0;
      |                         ^~~~~~~~~~~~
./src/yolo_layer.c: In function 'forward_yolo_layer':
./src/yolo_layer.c:707:11: warning: unused variable 'avg_anyobj' [-Wunused
-variable]
  707 |     float avg_anyobj = 0;
      |           ^~~~~~~~~~
./src/yolo_layer.c:706:11: warning: unused variable 'avg_obj' [-Wunused-va
riable]
  706 |     float avg_obj = 0;
      |           ^~~~~~~
./src/yolo_layer.c:705:11: warning: unused variable 'avg_cat' [-Wunused-va
riable]
  705 |     float avg_cat = 0;
      |           ^~~~~~~
./src/yolo_layer.c:704:11: warning: unused variable 'recall75' [-Wunused-v
ariable]
  704 |     float recall75 = 0;
      |           ^~~~~~~~
./src/yolo_layer.c:703:11: warning: unused variable 'recall' [-Wunused-var
iable]
  703 |     float recall = 0;
      |           ^~~~~~
./src/yolo_layer.c:702:11: warning: unused variable 'tot_ciou_loss' [-Wunu
sed-variable]
  702 |     float tot_ciou_loss = 0;
      |           ^~~~~~~~~~~~~
./src/yolo_layer.c:701:11: warning: unused variable 'tot_diou_loss' [-Wunu
```

```
sed-variable]
  701 |     float tot_diou_loss = 0;
      |           ^~~~~~~~~~~~~
./src/yolo_layer.c:698:11: warning: unused variable 'tot_ciou' [-Wunused-v
ariable]
  698 |     float tot_ciou = 0;
      |           ^~~~~~~~
./src/yolo_layer.c:697:11: warning: unused variable 'tot_diou' [-Wunused-v
ariable]
  697 |     float tot_diou = 0;
      |           ^~~~~~~~
./src/yolo_layer.c:696:11: warning: unused variable 'tot_giou' [-Wunused-v
ariable]
  696 |     float tot_giou = 0;
      |           ^~~~~~~~
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/gaussian_yolo_layer.c -o obj/gaussian
_yolo_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/upsample_layer.c -o obj/upsample_laye
r.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/lstm_layer.c -o obj/lstm_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/conv_lstm_layer.c -o obj/conv_lstm_la
yer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/scale_channels_layer.c -o obj/scale_c
hannels_layer.o
gcc -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wno-unused-result -Wno-u
nknown-pragmas -fPIC -rdynamic -Ofast -c ./src/sam_layer.c -o obj/sam_layer.o
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors -Wn
o-unused-result -Wno-unknown-pragmas -fPIC -rdynamic -Ofast obj/image_opencv.o obj/h
ttp_stream.o obj/gemm.o obj/utils.o obj/dark_cuda.o obj/convolutional_layer.o obj/li
st.o obj/image.o obj/activations.o obj/im2col.o obj/col2im.o obj/blas.o obj/crop_lay
er.o obj/dropout_layer.o obj/maxpool_layer.o obj/softmax_layer.o obj/data.o obj/matr
ix.o obj/network.o obj/connected_layer.o obj/cost_layer.o obj/parser.o obj/option_li
st.o obj/darknet.o obj/detection_layer.o obj/captcha.o obj/route_layer.o obj/writin
g.o obj/box.o obj/nightmare.o obj/normalization_layer.o obj/avgpool_layer.o obj/coc
o.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/ac
tivation_layer.o obj/rnn_layer.o obj/gru_layer.o obj/rnn.o obj/rnn_vid.o obj/crnn_la
yer.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/t
ree.o obj/yolo_layer.o obj/gaussian_yolo_layer.o obj/upsample_layer.o obj/lstm_laye
r.o obj/conv_lstm_layer.o obj/scale_channels_layer.o obj/sam_layer.o -o darknet -lm
 -pthread
```

사전 훈련된 가중치 다운로드

In [12]: `!cd darknet; wget https://pjreddie.com/media/files/yolov3.weights`

```
--2023-05-25 13:17:56--  https://pjreddie.com/media/files/yolov3.weights
Resolving pjreddie.com (pjreddie.com)... 128.208.4.108
Connecting to pjreddie.com (pjreddie.com)|128.208.4.108|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 248007048 (237M) [application/octet-stream]
Saving to: 'yolov3.weights'

yolov3.weights      100%[====================>] 236.52M  20.1MB/s    in 12s

2023-05-25 13:18:09 (19.3 MB/s) - 'yolov3.weights' saved [248007048/248007048]
```

02 yolo를 활용 - 예측수행

목차로 이동하기

```
In [17]:  ### 이미지 확인
          import matplotlib.pyplot as plt

          # 이미지 파일의 경로를 지정합니다.
          image_path = "/content/darknet/data/dog.jpg"

          # 이미지를 읽어옵니다.
          image = plt.imread(image_path)

          # 이미지를 출력합니다.
          plt.imshow(image)
          plt.show()
```



```
In [20]:  !cd darknet; ./darknet detect  cfg/yolov3.cfg  yolov3.weights  data/dog.jpg
```

```
 GPU isn't used
 OpenCV isn't used - data augmentation will be slow
mini_batch = 1, batch = 1, time_steps = 1, train = 0
   layer   filters  size/strd(dil)      input                output
   0 conv     32       3 x 3/ 1    416 x 416 x   3 ->  416 x 416 x  32 0.299 BF
   1 conv     64       3 x 3/ 2    416 x 416 x  32 ->  208 x 208 x  64 1.595 BF
   2 conv     32       1 x 1/ 1    208 x 208 x  64 ->  208 x 208 x  32 0.177 BF
   3 conv     64       3 x 3/ 1    208 x 208 x  32 ->  208 x 208 x  64 1.595 BF
   4 Shortcut Layer: 1,  wt = 0, wn = 0, outputs: 208 x 208 x  64 0.003 BF
   5 conv    128       3 x 3/ 2    208 x 208 x  64 ->  104 x 104 x 128 1.595 BF
   6 conv     64       1 x 1/ 1    104 x 104 x 128 ->  104 x 104 x  64 0.177 BF
   7 conv    128       3 x 3/ 1    104 x 104 x  64 ->  104 x 104 x 128 1.595 BF
   8 Shortcut Layer: 5,  wt = 0, wn = 0, outputs: 104 x 104 x 128 0.001 BF
   9 conv     64       1 x 1/ 1    104 x 104 x 128 ->  104 x 104 x  64 0.177 BF
  10 conv    128       3 x 3/ 1    104 x 104 x  64 ->  104 x 104 x 128 1.595 BF
  11 Shortcut Layer: 8,  wt = 0, wn = 0, outputs: 104 x 104 x 128 0.001 BF
  12 conv    256       3 x 3/ 2    104 x 104 x 128 ->   52 x  52 x 256 1.595 BF
  13 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  14 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  15 Shortcut Layer: 12,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  16 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  17 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  18 Shortcut Layer: 15,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  19 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  20 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  21 Shortcut Layer: 18,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  22 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  23 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  24 Shortcut Layer: 21,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  25 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  26 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  27 Shortcut Layer: 24,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  28 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  29 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  30 Shortcut Layer: 27,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  31 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  32 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  33 Shortcut Layer: 30,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  34 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  35 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  36 Shortcut Layer: 33,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  37 conv    512       3 x 3/ 2     52 x  52 x 256 ->   26 x  26 x 512 1.595 BF
  38 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  39 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  40 Shortcut Layer: 37,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  41 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  42 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  43 Shortcut Layer: 40,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  44 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  45 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  46 Shortcut Layer: 43,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  47 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  48 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  49 Shortcut Layer: 46,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  50 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  51 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  52 Shortcut Layer: 49,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  53 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  54 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  55 Shortcut Layer: 52,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  56 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  57 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  58 Shortcut Layer: 55,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  59 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  60 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
```

```
  61 Shortcut Layer: 58,  wt = 0, wn = 0,  outputs:  26 x  26 x 512 0.000 BF
  62 conv    1024       3 x 3/ 2    26 x  26 x 512 ->    13 x  13 x1024 1.595 BF
  63 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  64 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  65 Shortcut Layer: 62,  wt = 0, wn = 0,  outputs:  13 x  13 x1024 0.000 BF
  66 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  67 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  68 Shortcut Layer: 65,  wt = 0, wn = 0,  outputs:  13 x  13 x1024 0.000 BF
  69 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  70 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  71 Shortcut Layer: 68,  wt = 0, wn = 0,  outputs:  13 x  13 x1024 0.000 BF
  72 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  73 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  74 Shortcut Layer: 71,  wt = 0, wn = 0,  outputs:  13 x  13 x1024 0.000 BF
  75 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  76 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  77 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  78 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  79 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  80 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  81 conv     255       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 255 0.088 BF
  82 yolo
[yolo] params: iou loss: mse (2), iou_norm: 0.75, obj_norm: 1.00, cls_norm: 1.00, de
lta_norm: 1.00, scale_x_y: 1.00
  83 route  79                                 ->    13 x  13 x 512
  84 conv     256       1 x 1/ 1    13 x  13 x 512 ->    13 x  13 x 256 0.044 BF
  85 upsample            2x    13 x  13 x 256 ->    26 x  26 x 256
  86 route  85 61                              ->    26 x  26 x 768
  87 conv     256       1 x 1/ 1    26 x  26 x 768 ->    26 x  26 x 256 0.266 BF
  88 conv     512       3 x 3/ 1    26 x  26 x 256 ->    26 x  26 x 512 1.595 BF
  89 conv     256       1 x 1/ 1    26 x  26 x 512 ->    26 x  26 x 256 0.177 BF
  90 conv     512       3 x 3/ 1    26 x  26 x 256 ->    26 x  26 x 512 1.595 BF
  91 conv     256       1 x 1/ 1    26 x  26 x 512 ->    26 x  26 x 256 0.177 BF
  92 conv     512       3 x 3/ 1    26 x  26 x 256 ->    26 x  26 x 512 1.595 BF
  93 conv     255       1 x 1/ 1    26 x  26 x 512 ->    26 x  26 x 255 0.177 BF
  94 yolo
[yolo] params: iou loss: mse (2), iou_norm: 0.75, obj_norm: 1.00, cls_norm: 1.00, de
lta_norm: 1.00, scale_x_y: 1.00
  95 route  91                                 ->    26 x  26 x 256
  96 conv     128       1 x 1/ 1    26 x  26 x 256 ->    26 x  26 x 128 0.044 BF
  97 upsample            2x    26 x  26 x 128 ->    52 x  52 x 128
  98 route  97 36                              ->    52 x  52 x 384
  99 conv     128       1 x 1/ 1    52 x  52 x 384 ->    52 x  52 x 128 0.266 BF
 100 conv     256       3 x 3/ 1    52 x  52 x 128 ->    52 x  52 x 256 1.595 BF
 101 conv     128       1 x 1/ 1    52 x  52 x 256 ->    52 x  52 x 128 0.177 BF
 102 conv     256       3 x 3/ 1    52 x  52 x 128 ->    52 x  52 x 256 1.595 BF
 103 conv     128       1 x 1/ 1    52 x  52 x 256 ->    52 x  52 x 128 0.177 BF
 104 conv     256       3 x 3/ 1    52 x  52 x 128 ->    52 x  52 x 256 1.595 BF
 105 conv     255       1 x 1/ 1    52 x  52 x 256 ->    52 x  52 x 255 0.353 BF
 106 yolo
[yolo] params: iou loss: mse (2), iou_norm: 0.75, obj_norm: 1.00, cls_norm: 1.00, de
lta_norm: 1.00, scale_x_y: 1.00
Total BFLOPS 65.879
avg_outputs = 532444
Loading weights from yolov3.weights...
 seen 64, trained: 32013 K-images (500 Kilo-batches_64)
Done! Loaded 107 layers from weights-file
 Detection layer: 82 - type = 28
 Detection layer: 94 - type = 28
 Detection layer: 106 - type = 28
data/dog.jpg: Predicted in 9533.226000 milli-seconds.
bicycle: 99%
dog: 100%
truck: 93%
Not compiled with OpenCV, saving to predictions.png instead
```
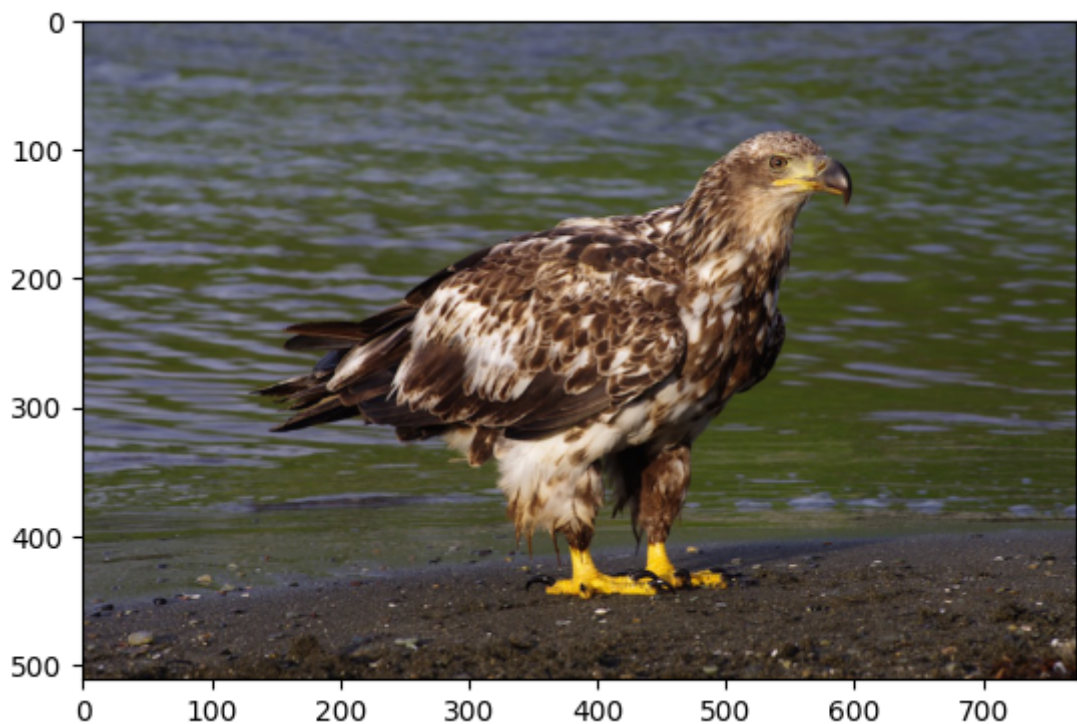
실습

- eagle.jpg를 해보기

In [21]:
```python
### 이미지 확인
import matplotlib.pyplot as plt

# 이미지 파일의 경로를 지정합니다.
image_path = "/content/darknet/data/eagle.jpg"

# 이미지를 읽어옵니다.
image = plt.imread(image_path)

# 이미지를 출력합니다.
plt.imshow(image)
plt.show()
```


In [26]:
```
!cd darknet; ./darknet detect   cfg/yolov3.cfg   yolov3.weights   data/eagle.jpg
```

```
 GPU isn't used
 OpenCV isn't used - data augmentation will be slow
mini_batch = 1, batch = 1, time_steps = 1, train = 0
   layer   filters  size/strd(dil)      input                output
   0 conv     32       3 x 3/ 1    416 x 416 x   3 ->  416 x 416 x  32 0.299 BF
   1 conv     64       3 x 3/ 2    416 x 416 x  32 ->  208 x 208 x  64 1.595 BF
   2 conv     32       1 x 1/ 1    208 x 208 x  64 ->  208 x 208 x  32 0.177 BF
   3 conv     64       3 x 3/ 1    208 x 208 x  32 ->  208 x 208 x  64 1.595 BF
   4 Shortcut Layer: 1,  wt = 0, wn = 0, outputs: 208 x 208 x  64 0.003 BF
   5 conv    128       3 x 3/ 2    208 x 208 x  64 ->  104 x 104 x 128 1.595 BF
   6 conv     64       1 x 1/ 1    104 x 104 x 128 ->  104 x 104 x  64 0.177 BF
   7 conv    128       3 x 3/ 1    104 x 104 x  64 ->  104 x 104 x 128 1.595 BF
   8 Shortcut Layer: 5,  wt = 0, wn = 0, outputs: 104 x 104 x 128 0.001 BF
   9 conv     64       1 x 1/ 1    104 x 104 x 128 ->  104 x 104 x  64 0.177 BF
  10 conv    128       3 x 3/ 1    104 x 104 x  64 ->  104 x 104 x 128 1.595 BF
  11 Shortcut Layer: 8,  wt = 0, wn = 0, outputs: 104 x 104 x 128 0.001 BF
  12 conv    256       3 x 3/ 2    104 x 104 x 128 ->   52 x  52 x 256 1.595 BF
  13 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  14 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  15 Shortcut Layer: 12,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  16 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  17 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  18 Shortcut Layer: 15,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  19 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  20 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  21 Shortcut Layer: 18,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  22 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  23 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  24 Shortcut Layer: 21,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  25 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  26 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  27 Shortcut Layer: 24,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  28 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  29 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  30 Shortcut Layer: 27,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  31 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  32 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  33 Shortcut Layer: 30,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  34 conv    128       1 x 1/ 1     52 x  52 x 256 ->   52 x  52 x 128 0.177 BF
  35 conv    256       3 x 3/ 1     52 x  52 x 128 ->   52 x  52 x 256 1.595 BF
  36 Shortcut Layer: 33,  wt = 0, wn = 0, outputs:  52 x  52 x 256 0.001 BF
  37 conv    512       3 x 3/ 2     52 x  52 x 256 ->   26 x  26 x 512 1.595 BF
  38 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  39 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  40 Shortcut Layer: 37,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  41 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  42 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  43 Shortcut Layer: 40,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  44 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  45 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  46 Shortcut Layer: 43,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  47 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  48 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  49 Shortcut Layer: 46,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  50 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  51 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  52 Shortcut Layer: 49,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  53 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  54 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  55 Shortcut Layer: 52,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  56 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  57 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
  58 Shortcut Layer: 55,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  59 conv    256       1 x 1/ 1     26 x  26 x 512 ->   26 x  26 x 256 0.177 BF
  60 conv    512       3 x 3/ 1     26 x  26 x 256 ->   26 x  26 x 512 1.595 BF
```

```
  61 Shortcut Layer: 58,  wt = 0, wn = 0, outputs:  26 x  26 x 512 0.000 BF
  62 conv    1024       3 x 3/ 2    26 x  26 x 512 ->    13 x  13 x1024 1.595 BF
  63 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  64 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  65 Shortcut Layer: 62,  wt = 0, wn = 0, outputs:  13 x  13 x1024 0.000 BF
  66 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  67 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  68 Shortcut Layer: 65,  wt = 0, wn = 0, outputs:  13 x  13 x1024 0.000 BF
  69 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  70 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  71 Shortcut Layer: 68,  wt = 0, wn = 0, outputs:  13 x  13 x1024 0.000 BF
  72 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  73 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  74 Shortcut Layer: 71,  wt = 0, wn = 0, outputs:  13 x  13 x1024 0.000 BF
  75 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  76 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  77 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  78 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  79 conv     512       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 512 0.177 BF
  80 conv    1024       3 x 3/ 1    13 x  13 x 512 ->    13 x  13 x1024 1.595 BF
  81 conv     255       1 x 1/ 1    13 x  13 x1024 ->    13 x  13 x 255 0.088 BF
  82 yolo
[yolo] params: iou loss: mse (2), iou_norm: 0.75, obj_norm: 1.00, cls_norm: 1.00, de
lta_norm: 1.00, scale_x_y: 1.00
  83 route  79                                  ->    13 x  13 x 512
  84 conv     256       1 x 1/ 1    13 x  13 x 512 ->    13 x  13 x 256 0.044 BF
  85 upsample             2x    13 x  13 x 256 ->    26 x  26 x 256
  86 route  85 61                               ->    26 x  26 x 768
  87 conv     256       1 x 1/ 1    26 x  26 x 768 ->    26 x  26 x 256 0.266 BF
  88 conv     512       3 x 3/ 1    26 x  26 x 256 ->    26 x  26 x 512 1.595 BF
  89 conv     256       1 x 1/ 1    26 x  26 x 512 ->    26 x  26 x 256 0.177 BF
  90 conv     512       3 x 3/ 1    26 x  26 x 256 ->    26 x  26 x 512 1.595 BF
  91 conv     256       1 x 1/ 1    26 x  26 x 512 ->    26 x  26 x 256 0.177 BF
  92 conv     512       3 x 3/ 1    26 x  26 x 256 ->    26 x  26 x 512 1.595 BF
  93 conv     255       1 x 1/ 1    26 x  26 x 512 ->    26 x  26 x 255 0.177 BF
  94 yolo
[yolo] params: iou loss: mse (2), iou_norm: 0.75, obj_norm: 1.00, cls_norm: 1.00, de
lta_norm: 1.00, scale_x_y: 1.00
  95 route  91                                  ->    26 x  26 x 256
  96 conv     128       1 x 1/ 1    26 x  26 x 256 ->    26 x  26 x 128 0.044 BF
  97 upsample             2x    26 x  26 x 128 ->    52 x  52 x 128
  98 route  97 36                               ->    52 x  52 x 384
  99 conv     128       1 x 1/ 1    52 x  52 x 384 ->    52 x  52 x 128 0.266 BF
 100 conv     256       3 x 3/ 1    52 x  52 x 128 ->    52 x  52 x 256 1.595 BF
 101 conv     128       1 x 1/ 1    52 x  52 x 256 ->    52 x  52 x 128 0.177 BF
 102 conv     256       3 x 3/ 1    52 x  52 x 128 ->    52 x  52 x 256 1.595 BF
 103 conv     128       1 x 1/ 1    52 x  52 x 256 ->    52 x  52 x 128 0.177 BF
 104 conv     256       3 x 3/ 1    52 x  52 x 128 ->    52 x  52 x 256 1.595 BF
 105 conv     255       1 x 1/ 1    52 x  52 x 256 ->    52 x  52 x 255 0.353 BF
 106 yolo
[yolo] params: iou loss: mse (2), iou_norm: 0.75, obj_norm: 1.00, cls_norm: 1.00, de
lta_norm: 1.00, scale_x_y: 1.00
Total BFLOPS 65.879
avg_outputs = 532444
Loading weights from yolov3.weights...
 seen 64, trained: 32013 K-images (500 Kilo-batches_64)
Done! Loaded 107 layers from weights-file
 Detection layer: 82 - type = 28
 Detection layer: 94 - type = 28
 Detection layer: 106 - type = 28
data/eagle.jpg: Predicted in 8527.034000 milli-seconds.
bird: 99%
Not compiled with OpenCV, saving to predictions.png instead
```
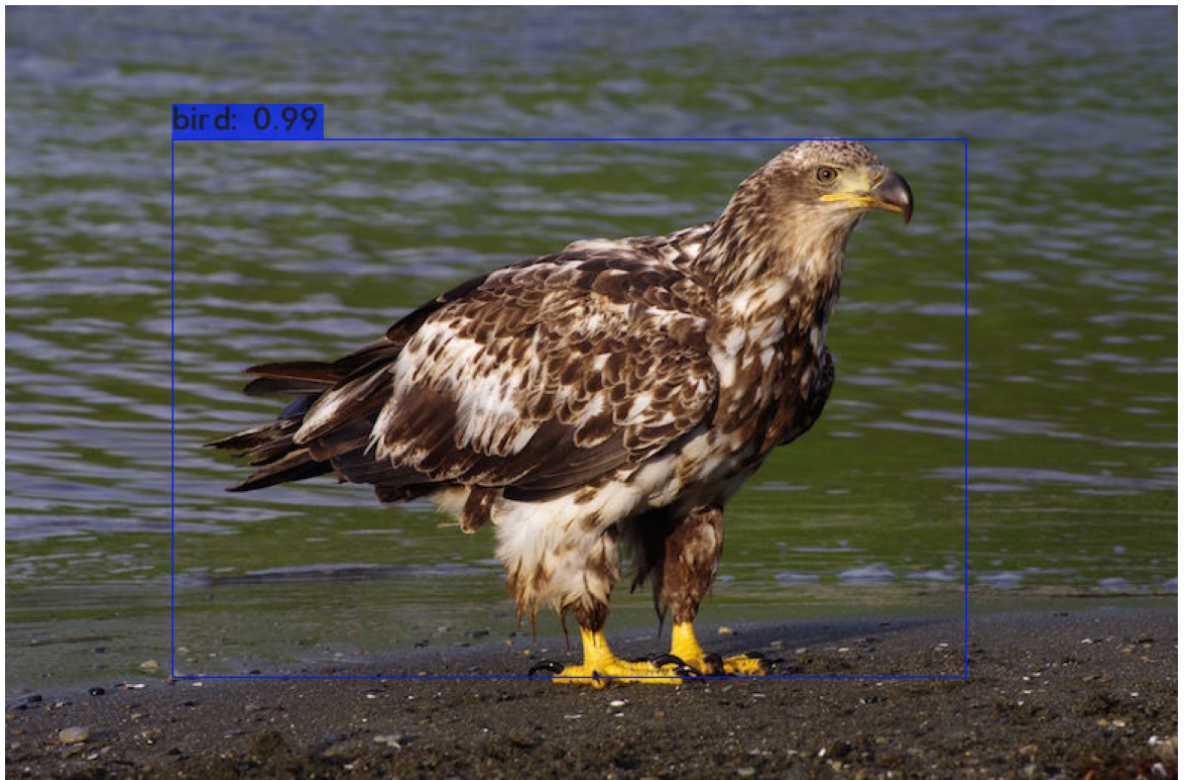
03 yolo 예측 결과 확인

목차로 이동하기

In [28]:
```python
import cv2
import matplotlib.pyplot as plt

def show_detection_result(path):
    image = cv2.imread(path)
    fig = plt.gcf()
    fig.set_size_inches(18,10)
    plt.axis('off')
    plt.imshow(cv2.cvtColor(image, cv2.COLOR_BGR2RGB))

path = "/content/darknet/predictions.jpg"
show_detection_result(path)
```


실습

- horses.jpg에 대해 수행해 보기