

# Tinker board

IoT를 위한 최선의 엣지 단말기



MAKER SPACE  
**G·CAMP**

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# The Spaghetti Detective

- 3D 프린터의 출력 불량을 감지해 주는 서비스
- 해당 서비스는 오픈 소스로 제공 중
- <https://www.thespaghettidetector.com/> -> 공식 홈페이지
- <https://github.com/TheSpaghettiDetective/TheSpaghettiDetective> -> Github
- Github에서 TheSpaghettiDetective/docs/model\_development.md를 확인 시,  
ML 모델에 관한 설명이 있음  
해당 모델은 YOLOv2 CNN으로 구현된 객체 탐지 모델이며,  
AlexeyAB darknet을 사용하여 실행

# ML model development guide

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The following instructions will assist you in making changes to the ML model or its integration into the Spaghetti Detective service.

*If you follow this guide and run into problems, please seek help at: <https://obico.io/discord>*

## Overview & Architecture

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Model data, libraries, and scripts are located in `ml_api/`.

The TSD model uses a convolutional neural network adapted from YOLOv2, which is a machine learning model designed for the task of object detection and localization in images.

The model is run using <https://github.com/AlexeyAB/darknet>. **This is a fork of the original Darknet framework with substantial changes made to how the model is loaded and evaluated**, and running on the "old" darknet will cause weird failures as a result.

Darknet itself is a C-based framework that compiles to a **shared library** which we then access in Python via the `ctypes` library (see `ml_api/lib/detection_model.py`). These shared libraries live in `ml_api/bin/*.so` and are specific to the architecture of whatever's hosting the `ml_api` docker container.

The model is set up and hosted via `server.py`, which provides a `/p/?img=...` URL endpoint on port `3333` of the `ml_api` container.

When passed an image URL, the server:

# YOLOv2

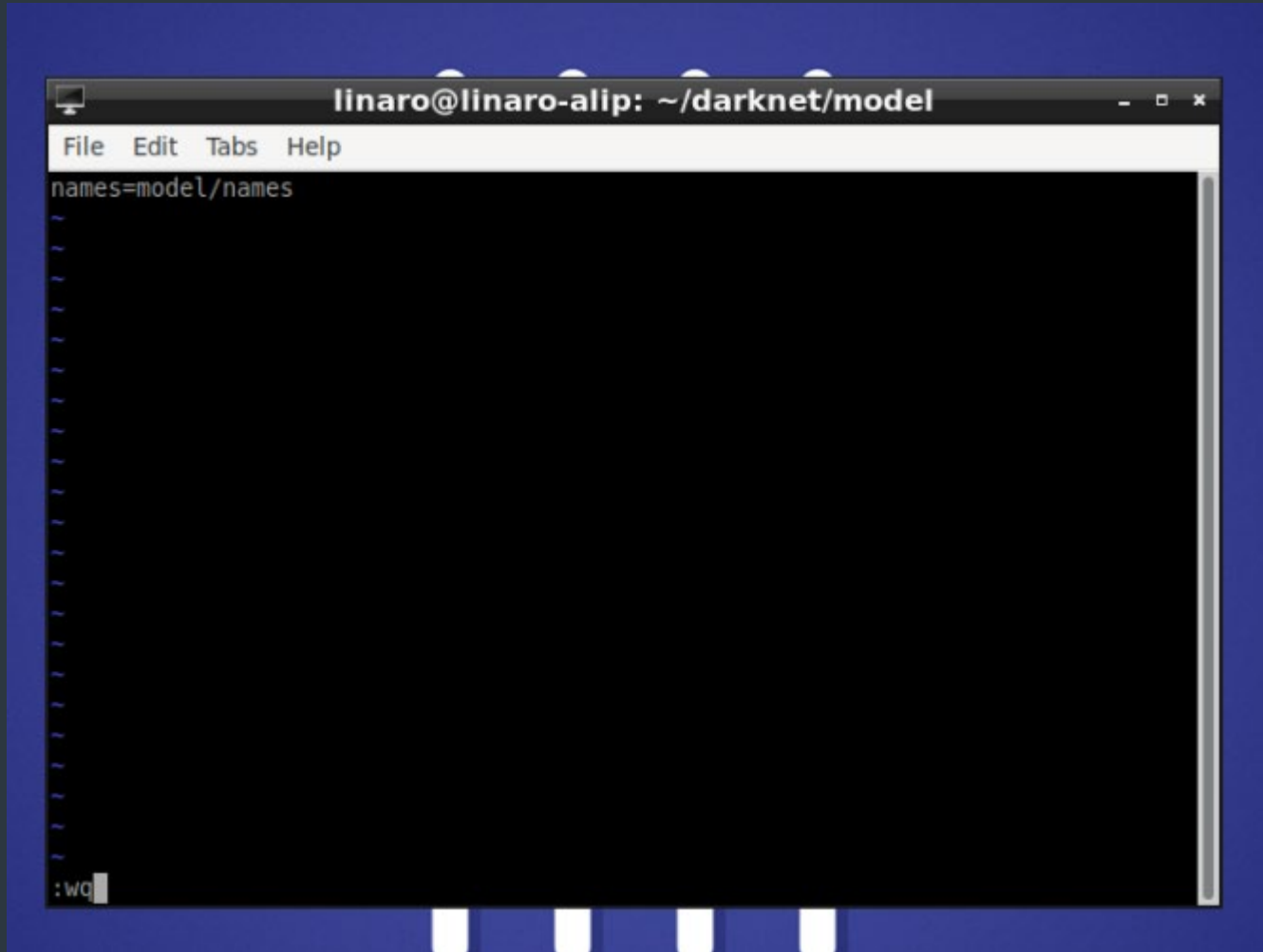
- YOLO는 You only look once의 줄임말
- 높은 정확도와 빠른 속도를 자랑하는 객체 탐지기 중의 하나
- 뛰어난 성능에 비해 사용법이 간단해서 인기가 많음
- <https://pjreddie.com/darknet/yolo/> -> 공식 홈페이지
- YOLO를 사용하기 위해선 이를 실행할 프레임워크를 설치해야 하는데, 공식 홈페이지에서 안내하고 있는 Darknet으로 진행

# OpenCV

```
linaro@linaro-alip: ~  
File Edit Tabs Help  
linaro@linaro-alip:~$ git clone https://github.com/TheSpaghettiDetective/TheSpag  
hettiDetective.git  
Cloning into 'TheSpaghettiDetective'...  
remote: Enumerating objects: 26591, done.  
remote: Counting objects: 100% (358/358), done.  
remote: Compressing objects: 100% (269/269), done.  
remote: Total 26591 (delta 148), reused 202 (delta 79), pack-reused 26233  
Receiving objects: 100% (26591/26591), 145.72 MiB | 10.21 MiB/s, done.  
Resolving deltas: 100% (20068/20068), done.  
Checking out files: 100% (803/803), done.  
linaro@linaro-alip:~$ git clone https://github.com/AlexeyAB/darknet.git  
Cloning into 'darknet'...  
remote: Enumerating objects: 15412, done.  
remote: Total 15412 (delta 0), reused 0 (delta 0), pack-reused 15412  
Receiving objects: 100% (15412/15412), 14.05 MiB | 8.71 MiB/s, done.  
Resolving deltas: 100% (10354/10354), done.  
linaro@linaro-alip:~$
```

- git clone  
<https://github.com/TheSpaghettiDetective/TheSpaghettiDetective.git>
- git clone  
<https://github.com/AlexeyAB/darknet.git>
- The Spaghetti Detective와 Darknet의 소스코드를 Git에서 다운로드

# OpenCV



- `cp -r`  
TheSpaghettiDetective/ml\_api/model darknet
- `cd darknet/model/`
- `nano model.data`
- The Spaghetti Detective의 YOLO 모델은 ml\_api 폴더에 정의
- Darknet에서 사용하기 위해 The Spaghetti Detective의 모델 폴더를 Darknet 폴더로 복사
- `names=model/Names` 입력



# OpenCV

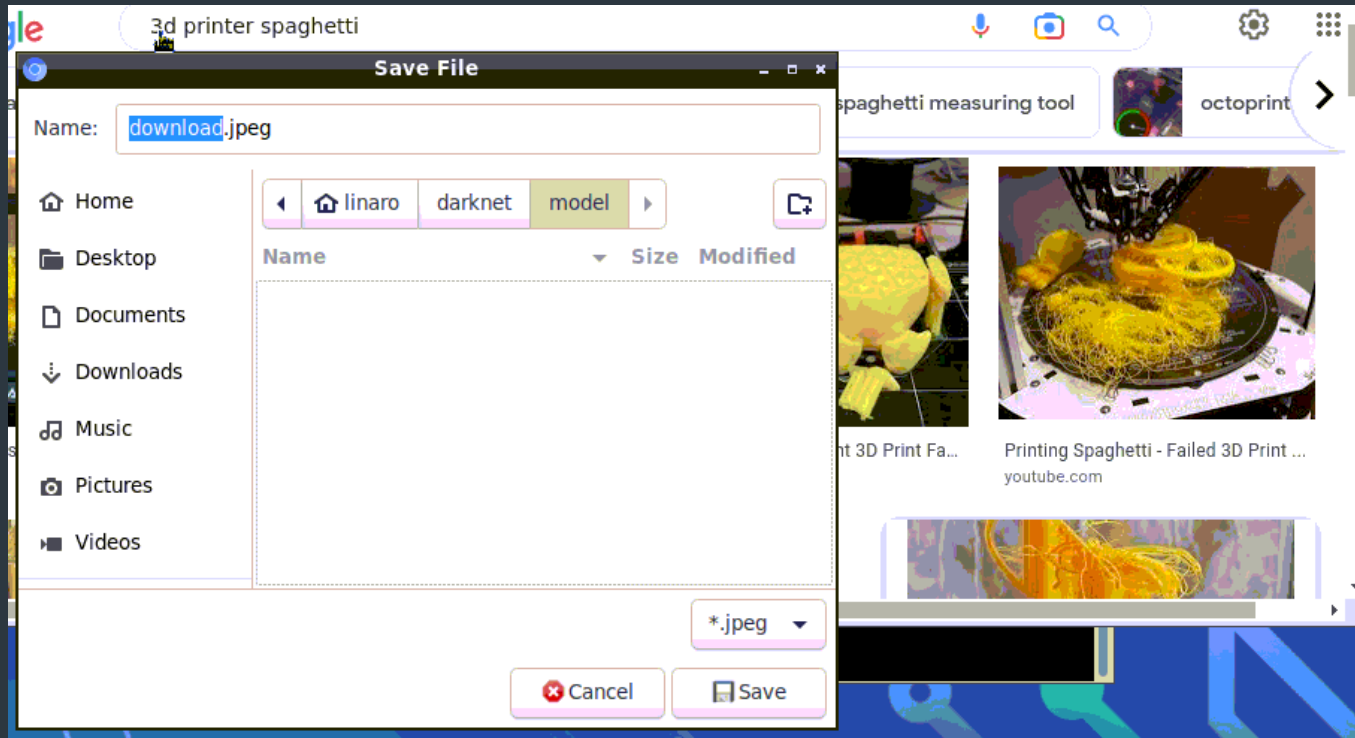
```
linaro@linaro-alip: ~/darknet/model
File Edit Tabs Help
linaro@linaro-alip:~/darknet/model$ cat model.weights.url
https://tsd-pub-static.s3.amazonaws.com/ml-models/3209.neg_32213.22300.weights
linaro@linaro-alip:~/darknet/model$ wget -O model.weights https://tsd-pub-static
.s3.amazonaws.com/ml-models/3209.neg_32213.22300.weights
--2022-05-03 16:20:04-- https://tsd-pub-static.s3.amazonaws.com/ml-models/3209.
neg_32213.22300.weights
Resolving tsd-pub-static.s3.amazonaws.com (tsd-pub-static.s3.amazonaws.com)... 5
2.217.44.84
Connecting to tsd-pub-static.s3.amazonaws.com (tsd-pub-static.s3.amazonaws.com)|
52.217.44.84|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 202314764 (193M) [application/octet-stream]
Saving to: 'model.weights'

model.weights      28%[====>          ] 55.73M  7.99MB/s   eta 19s
```

- `cat model.weights.url`
- `wget -O model.weights https://tsd-pub-static.s3.amazonaws.com/ml-models/3209.neg_32213.22300.weights`
- 모델 파일이 비어 있으므로 필요한 해당 모델 파일 다운



# OpenCV



- 구글에서 적당한 사진을 찾아서 다운
- 3d printer spaghetti 로 검색 추천
- darknet/model/ 폴더에 다운

# OpenCV

```
linaro@linaro-alip:~/darknet/model$ cd ..
linaro@linaro-alip:~/darknet$ make
mkdir -p ./obj/
mkdir -p backup
chmod +x *.sh
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors
-Wno-unused-result -Wno-unknown-pragmas -fPIC -Ofast -c ./src/image_opencv.cpp
-o obj/image_opencv.o
g++ -std=c++11 -std=c++11 -Iinclude/ -I3rdparty/stb/include -Wall -Wfatal-errors
-Wno-unused-result -Wno-unknown-pragmas -fPIC -Ofast -c ./src/http_stream.cpp -
o obj/http_stream.o
./src/http_stream.cpp: In member function 'bool JSON_sender::write(const char*)':
./src/http_stream.cpp:253:21: warning: unused variable 'n' [-Wunused-variable]
    int n = _write(client, outputbuf, outlen);
        ^
./src/http_stream.cpp: In function 'void set_track_id(detection*, int, float, fl
oat, float, int, int, int)':
./src/http_stream.cpp:867:27: warning: comparison of integer expressions of diff
erent signedness: 'int' and 'std::vector<detection_t>::size_type' {aka 'long uns
```

- make
- Makefile이 있는 경로에서 make 명령어를 통해 소스코드를 빌드

# OpenCV

```
linaro@linaro-alip:~/darknet$ ./darknet detector test model/model.data model/model
el.cfg model/model.weights model/download.jpeg
GPU isn't used
OpenCV isn't used - data augmentation will be slow
mini_batch = 1, batch = 8, 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 max		2x 2/ 2	416 x 416 x 32 ->	208 x 208 x 32 0.006 BF
2 conv	64	3 x 3/ 1	208 x 208 x 32 ->	208 x 208 x 64 1.595 BF
3 max		2x 2/ 2	208 x 208 x 64 ->	104 x 104 x 64 0.003 BF
4 conv	128	3 x 3/ 1	104 x 104 x 64 ->	104 x 104 x 128 1.595 BF
5 conv	64	1 x 1/ 1	104 x 104 x 128 ->	104 x 104 x 64 0.177 BF
6 conv	128	3 x 3/ 1	104 x 104 x 64 ->	104 x 104 x 128 1.595 BF
7 max		2x 2/ 2	104 x 104 x 128 ->	52 x 52 x 128 0.001 BF
8 conv	256	3 x 3/ 1	52 x 52 x 128 ->	52 x 52 x 256 1.595 BF
9 conv	128	1 x 1/ 1	52 x 52 x 256 ->	52 x 52 x 128 0.177 BF
10 conv	256	3 x 3/ 1	52 x 52 x 128 ->	52 x 52 x 256 1.595 BF
11 max		2x 2/ 2	52 x 52 x 256 ->	26 x 26 x 256 0.001 BF
12 conv	512	3 x 3/ 1	26 x 26 x 256 ->	26 x 26 x 512 1.595 BF
13 conv	256	1 x 1/ 1	26 x 26 x 512 ->	26 x 26 x 256 0.177 BF
14 conv	512	3 x 3/ 1	26 x 26 x 256 ->	26 x 26 x 512 1.595 BF
15 conv	256	1 x 1/ 1	26 x 26 x 512 ->	26 x 26 x 256 0.177 BF
16 conv	512	3 x 3/ 1	26 x 26 x 256 ->	26 x 26 x 512 1.595 BF

- ./darknet detector test  
model/model.data  
model/model.cfg  
model/model.weights  
model/download.jpeg  
로 다크넷에서 다운 받았던 jpg  
파일을 모델로 분석

# OpenCV

predictions.jpg (300x168) 100%

