



Ciencia y Tecnología

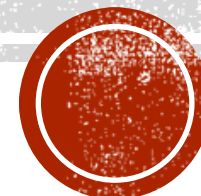
Secretaría de Ciencia, Humanidades, Tecnología e Innovación



CIMAT
UNIDAD MÉRIDA

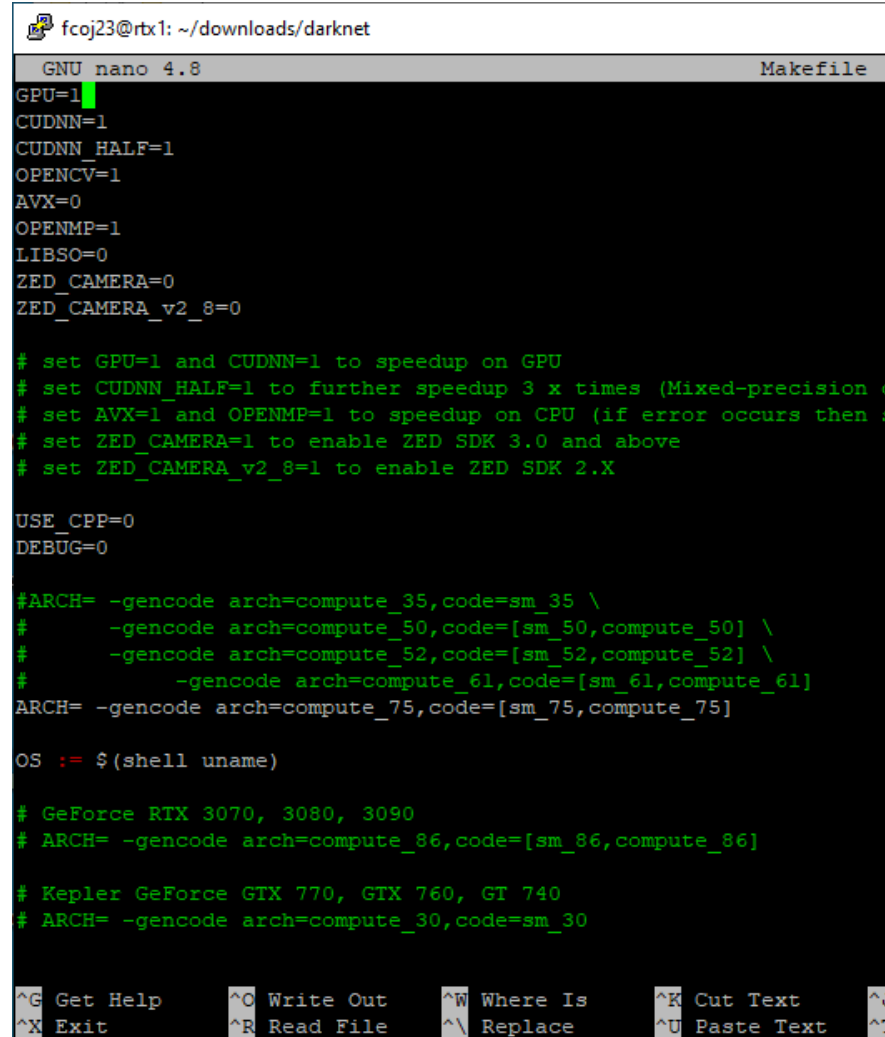
YOLO - DARKNET

Dr. Francisco J. Hernández López
SECIHTI – CIMAT-Mérida
fcoj23@cimat.mx, www.cimat.mx/~fcoj23



INSTALAR DARKNET

- git clone
<https://github.com/AlexeyAB/darknet.git>
- cd darknet/
- Modificar el archivo “Makefile”
- make



```
fcoj23@rtx1: ~/downloads/darknet
GNU nano 4.8 Makefile
GPU=1
CUDNN=1
CUDNN_HALF=1
OPENCV=1
AVX=0
OPENMP=1
LIBSO=0
ZED_CAMERA=0
ZED_CAMERA_v2_8=0

# set GPU=1 and CUDNN=1 to speedup on GPU
# set CUDNN_HALF=1 to further speedup 3 x times (Mixed-precision)
# set AVX=1 and OPENMP=1 to speedup on CPU (if error occurs then)
# set ZED_CAMERA=1 to enable ZED SDK 3.0 and above
# set ZED_CAMERA_v2_8=1 to enable ZED SDK 2.X

USE_CPP=0
DEBUG=0

#ARCH= -gencode arch=compute_35,code=sm_35 \
#       -gencode arch=compute_50,code=[sm_50,compute_50] \
#       -gencode arch=compute_52,code=[sm_52,compute_52] \
#       -gencode arch=compute_61,code=[sm_61,compute_61]
ARCH= -gencode arch=compute_75,code=[sm_75,compute_75]

OS := $(shell uname)

# GeForce RTX 3070, 3080, 3090
# ARCH= -gencode arch=compute_86,code=[sm_86,compute_86]

# Kepler GeForce GTX 770, GTX 760, GT 740
# ARCH= -gencode arch=compute_30,code=sm_30

^G Get Help  ^O Write Out  ^W Where Is  ^K Cut Text
^X Exit      ^R Read File  ^\ Replace   ^U Paste Text
```

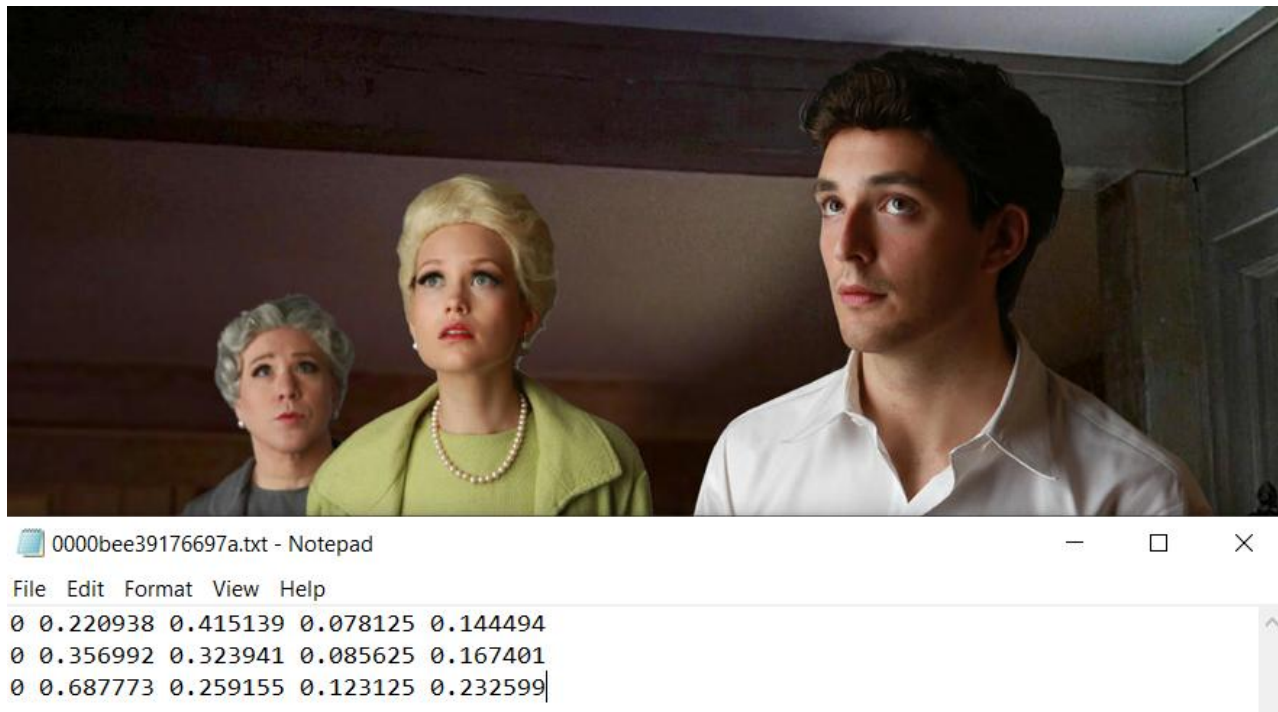
FACE-DETECTION-DATASET (KAGGLE)

<https://www.kaggle.com/fareselmenshawii/face-detection-dataset>

- El conjunto de datos se obtuvo empleando el kit de herramientas OIDv4, para extraer datos de Google Open Images
- Aprox. 4.43 GB
- Contiene 3 carpetas:
 - Images: Contiene las imágenes para entren. (13386) y valid. (3347)
 - Labels: Contiene las etiquetas en formato YOLO par las carpetas de entrenamiento y validación

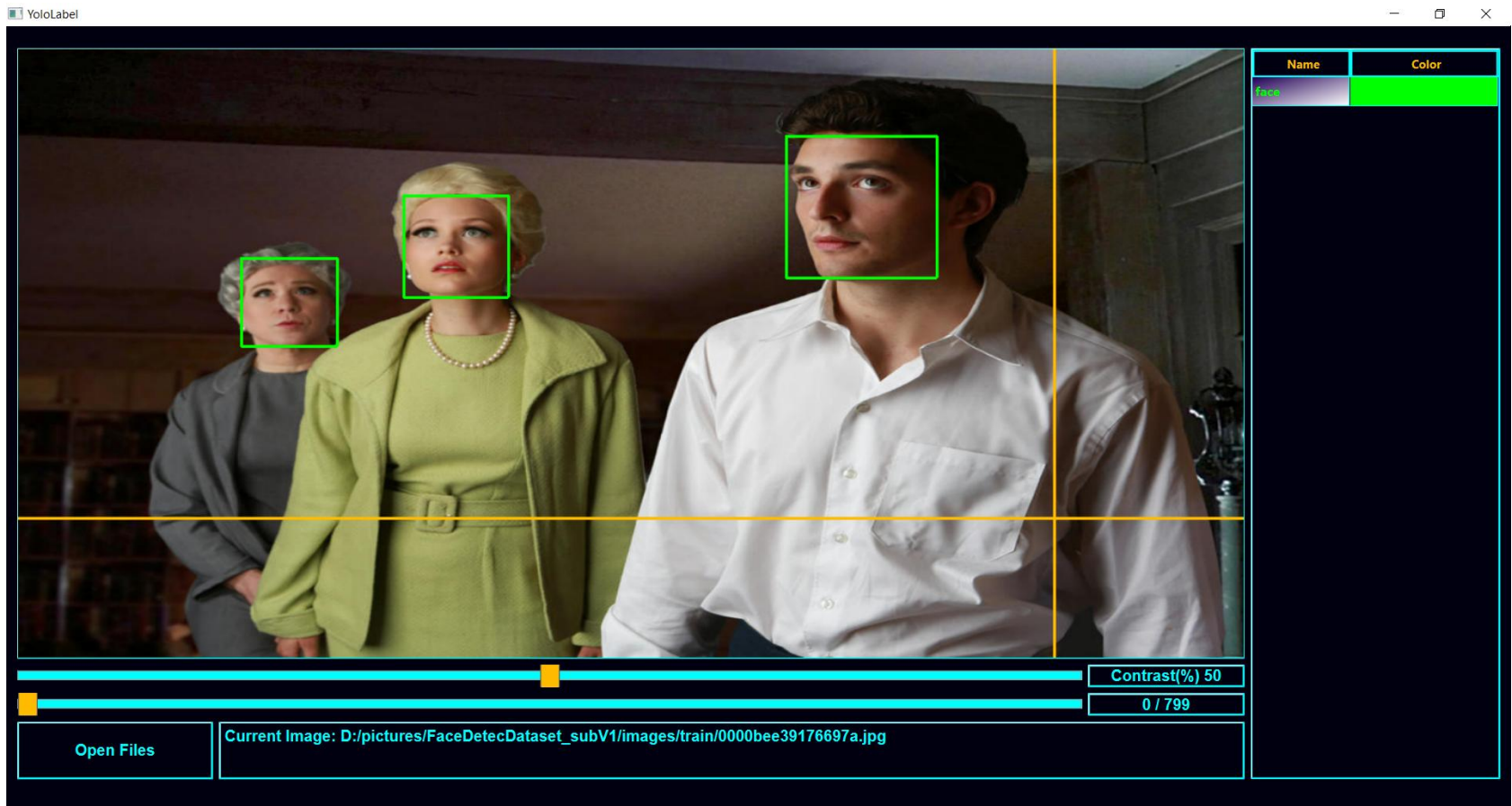
SUBCONJUNTO DEL FASE-DETECT-DATASET

- Vamos a tomar solo un subconjunto de este dataset:
 - Entrenamiento: 800 imágenes (80%)
 - Validación: 200 imágenes (20%)



YOLO-LABEL

https://github.com/developer0hye/Yolo_Label



CALCULAR LAS CAJAS DE ANCLAJE

- **./darknet detector calc_anchors**
FaceDetecDataset_subV1/obj.data -num_of_clusters 9 -width 608 -height 608 -show

num_of_clusters = 9, width = 608, height = 608

read labels from 800 images

loaded image: 800 box: 2327

all loaded.

calculating k-means++ ...

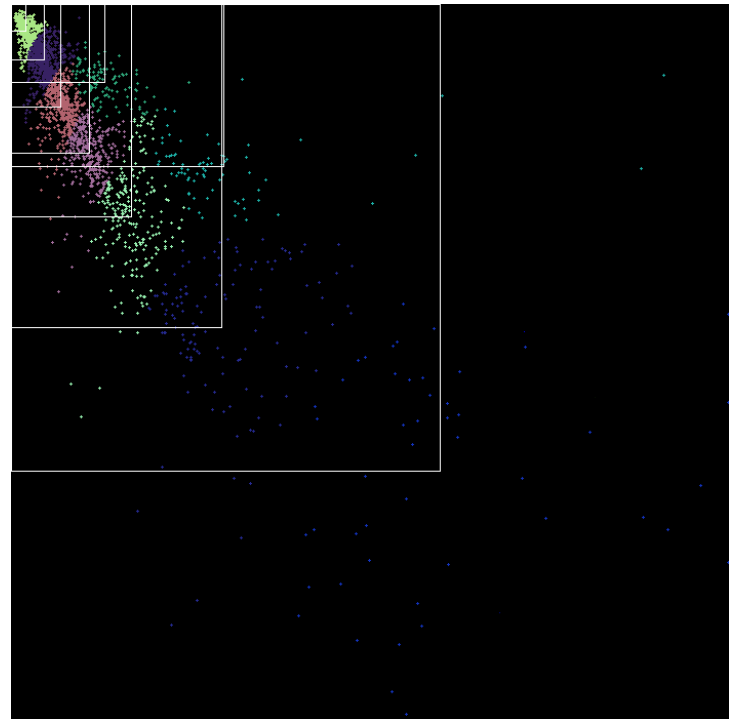
iterations = 94

counters_per_class = 2327

avg IoU = 69.79 %

Saving anchors to the file: anchors.txt

anchors = 13, 23, 28, 48, 42, 87, 80, 67,
66, 126, 102, 180, 180, 138, 179, 274, 364, 396



MODIFICAR ARCHIVO .CFG DE YOLO

- **Batch=64** (Cantidad de imágenes utilizadas en el *Forward-Propag.* para calcular un gradiente y actualizar los pesos mediante *Back-Propag.*)
- **Subdivisions=16** (Depende de la RAM de la GPU, Batch/Subdivisons es el núm. de imágenes que se procesan en paralelo en la GPU)
- **max_batches=6000** (classes*2000 pero no menor que el num. de imag. de entrenam. y no menor que 6000), ej. max_batches=6000 si classes=3
- **Steps=4800,5400** es el 80% y el 90% de max_batches
- **Tamaño de entrada de la red (width=608, height=608)** debe ser múltiplo de 32
- **Classes=1** número de clases que hay que cambiar en cada uno de los tres [yolo]-layers del archivo
- **anchor=** 13, 23, 28, 48, 42, 87, 80, 67, 66, 126, 102, 180, 180, 138, 179, 274, 364, 396
- **[filters=18]** (classes + 5)x3 en los tres [convolutional] antes de cada [yolo]
- Si classes==1 entonces filters=18. Si classes==2 entonces filters=21.

ENTRENAMIENTO

- Descargar los pesos pre-entrenados de YOLOv4:
 - yolov4.conv.137:
https://github.com/AlexeyAB/darknet/releases/download/darknet_yolo_v3_optimal/yolov4.conv.137
- `./darknet detector train FaceDetecDataset_subV1/obj.data yolov4-FaceDetec_train.cfg yolov4.conv.137 -map -dont_show > FaceDetecDataset_subV1/train.log`

```
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.374654), count: 21, class_loss = 478.241974, iou_loss = 0.534027, total_loss = 478.776001
total_bbox = 61836, rewritten_bbox = 0.029109 %
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 139 Avg (IOU: 0.357523), count: 4, class_loss = 7308.992188, iou_loss = 1.535645, total_loss = 7310.527832
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 150 Avg (IOU: 0.380599), count: 19, class_loss = 1607.462280, iou_loss = 2.047607, total_loss = 1609.509888
v3 (iou loss, Normalizer: (iou: 0.07, obj: 1.00, cls: 1.00) Region 161 Avg (IOU: 0.358603), count: 24, class_loss = 476.473541, iou_loss = 0.424438, total_loss = 476.897980
```

Htop

fcoj23@rtx1: ~

1	[100.0%]	7	[18.7%]	13	[8.4%]	19	[10.4%]
2	[100.0%]	8	[12.5%]	14	[7.2%]	20	[9.2%]
3	[21.7%]	9	[13.8%]	15	[8.5%]	21	[8.6%]
4	[37.9%]	10	[12.0%]	16	[9.0%]	22	[9.7%]
5	[69.5%]	11	[41.7%]	17	[8.4%]	23	[7.8%]
6	[17.3%]	12	[41.2%]	18	[7.9%]	24	[9.1%]

Mem[||||| 6.62G/62.5G] Tasks: 121, 191 thr; 4 running
 Swp[0K/8.00G] Load average: 4.81 2.68 2.23
 Uptime: 18 days, 03:16:08

PID	USER	PRI	NI	VIRT	RES	SHR	S	CPU%	MEM%	TIME+	Command
64338	fcoj23	20	0	54.5G	6109M	518M	R	376.	9.5	1:57.38	./darknet d
63879	jcisneros	20	0	910M	84644	25084	R	99.5	0.1	3h11:01	python3 gen
63801	jcisneros	20	0	910M	84840	25256	R	99.5	0.1	3h11:08	python3 gen
64347	fcoj23	20	0	54.5G	6109M	518M	S	40.6	9.5	0:05.51	./darknet d
64345	fcoj23	20	0	54.5G	6109M	518M	S	36.0	9.5	0:05.90	./darknet d
64349	fcoj23	20	0	54.5G	6109M	518M	S	12.4	9.5	0:04.10	./darknet d
64350	fcoj23	20	0	54.5G	6109M	518M	S	11.8	9.5	0:03.40	./darknet d
64346	fcoj23	20	0	54.5G	6109M	518M	S	11.1	9.5	0:05.53	./darknet d
64348	fcoj23	20	0	54.5G	6109M	518M	S	10.5	9.5	0:03.97	./darknet d
64372	fcoj23	20	0	54.5G	6109M	518M	S	7.9	9.5	0:01.24	./darknet d
64365	fcoj23	20	0	54.5G	6109M	518M	S	7.2	9.5	0:01.25	./darknet d

F1Help F2Setup F3Search F4Filter F5Tree F6SortBy F7Nice - F8Nice + F9Kill F10Q

NVIDIA-SMI

nvidia-smi -l 1

```
fcoj23@rtx1: ~  
+-----+  
| NVIDIA-SMI 460.32.03      Driver Version: 460.32.03      CUDA Version: 11.2      |  
+-----+-----+-----+  
| GPU   Name                Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |  
| Fan   Temp   Perf    Pwr:Usage/Cap|      Memory-Usage | GPU-Util  Compute M. |  
|                                           | MIG M.         |  
+-----+-----+-----+  
|    0   TITAN RTX             On      | 00000000:17:00.0 Off  |          N/A         |  
| 99%    86C    P2      220W / 280W | 18201MiB / 24220MiB |      86%    Default  |  
|                                           |          N/A         |  
+-----+-----+-----+  
+-----+  
| Processes:                                     |  
|  GPU   GI    CI          PID    Type    Process name                  GPU Memory |  
|       ID    ID                                   |          Usage        |  
+-----+-----+-----+  
|    0   N/A   N/A         6669     G   /usr/lib/xorg/Xorg              4MiB |  
|    0   N/A   N/A        64338     C   ./darknet                      18193MiB |  
+-----+-----+-----+
```

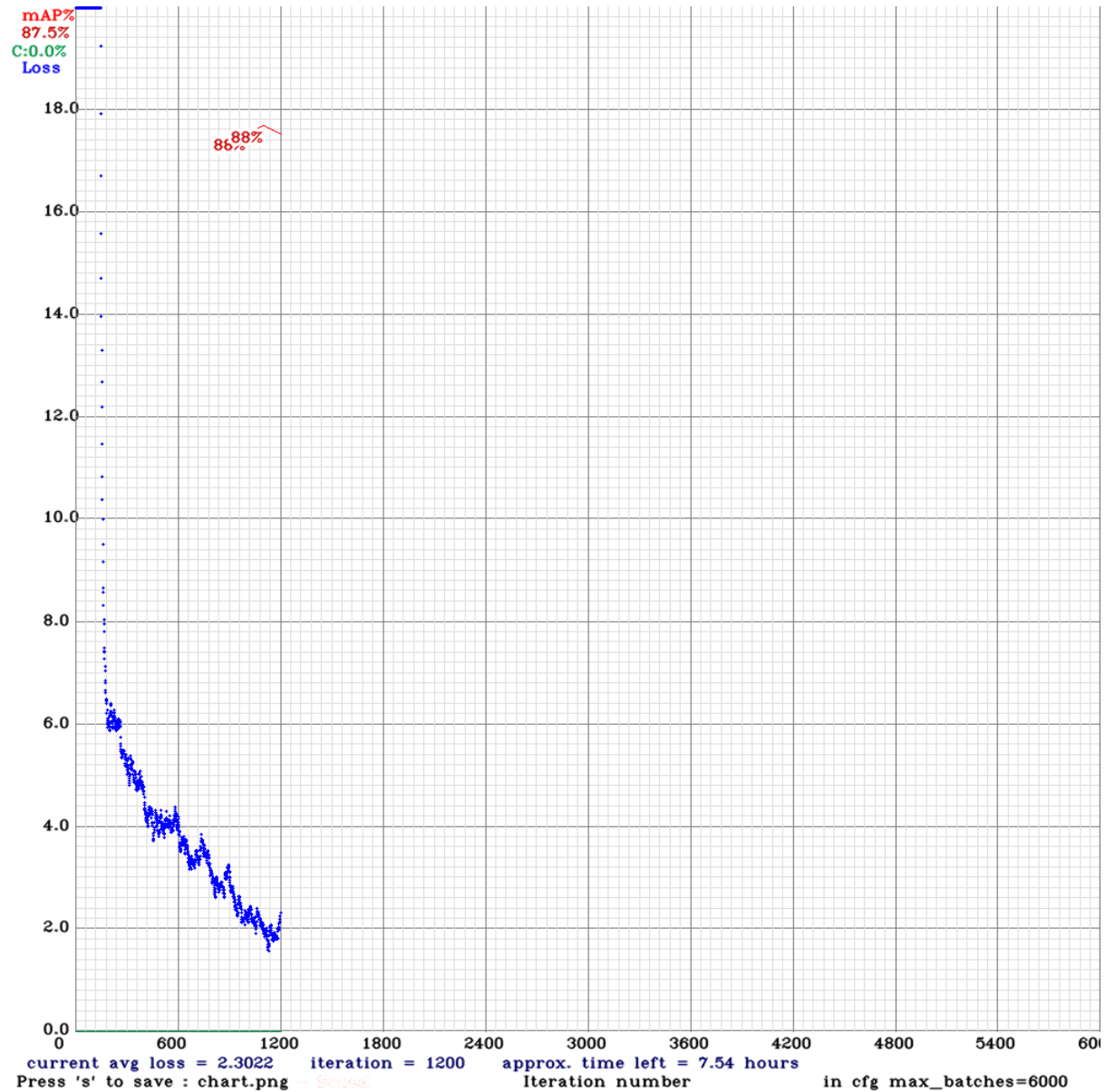
¿CÓMO VA EL ENTRENAMIENTO?

grep "avg" FaceDetecDataset_subV1/train.log

```
fcoj23@rtx1:~/downloads/darknet$ grep "avg" FaceDetecDataset_subV1/train.log
1: 5427.008301, 5427.008301 avg loss, 0.000000 rate, 4.664203 seconds, 64 images, -1.000000 hours left
2: 5426.323242, 5426.939941 avg loss, 0.000000 rate, 4.237279 seconds, 128 images, 648.460958 hours left
3: 5425.117676, 5426.757812 avg loss, 0.000000 rate, 4.220216 seconds, 192 images, 647.867423 hours left
4: 5431.368164, 5427.218750 avg loss, 0.000000 rate, 4.223999 seconds, 256 images, 647.256072 hours left
5: 5425.723633, 5427.069336 avg loss, 0.000000 rate, 4.441825 seconds, 320 images, 646.656077 hours left
6: 5415.039551, 5425.866211 avg loss, 0.000000 rate, 4.663491 seconds, 384 images, 646.364924 hours left
7: 5408.686523, 5424.148438 avg loss, 0.000000 rate, 4.871707 seconds, 448 images, 646.384845 hours left
8: 5428.757812, 5424.609375 avg loss, 0.000000 rate, 4.975479 seconds, 512 images, 646.694020 hours left
9: 5431.627441, 5425.311035 avg loss, 0.000000 rate, 5.111208 seconds, 576 images, 647.144383 hours left
10: 5425.229980, 5425.302734 avg loss, 0.000000 rate, 5.195512 seconds, 640 images, 647.778905 hours left
11: 4314.066895, 5314.179199 avg loss, 0.000000 rate, 4.313348 seconds, 704 images, 648.524286 hours left
12: 4324.183594, 5215.179688 avg loss, 0.000000 rate, 4.450318 seconds, 768 images, 648.035746 hours left
```

```
145: 5.665501, 19.277523 avg loss, 0.000000 rate, 1.683193 seconds, 9280 images, 506.226092 hours left
146: 5.695033, 17.919273 avg loss, 0.000000 rate, 1.637801 seconds, 9344 images, 503.503329 hours left
147: 6.615353, 16.788881 avg loss, 0.000000 rate, 1.648340 seconds, 9408 images, 500.744705 hours left
148: 4.688131, 15.578806 avg loss, 0.000000 rate, 1.616517 seconds, 9472 images, 498.028310 hours left
149: 4.905978, 14.511523 avg loss, 0.000000 rate, 1.635936 seconds, 9536 images, 495.294878 hours left
150: 6.733457, 13.733717 avg loss, 0.000001 rate, 1.655325 seconds, 9600 images, 492.615734 hours left
151: 5.410782, 12.901423 avg loss, 0.000001 rate, 4.186024 seconds, 9664 images, 489.990336 hours left
152: 5.572734, 12.168554 avg loss, 0.000001 rate, 4.283082 seconds, 9728 images, 490.908491 hours left
153: 6.967654, 11.648464 avg loss, 0.000001 rate, 4.390811 seconds, 9792 images, 491.952360 hours left
154: 8.232637, 11.306882 avg loss, 0.000001 rate, 4.421748 seconds, 9856 images, 493.135516 hours left
155: 8.653145, 11.041508 avg loss, 0.000001 rate, 4.450928 seconds, 9920 images, 494.349814 hours left
```

LOSS Y MAP



ANALIZANDO EL MAP

- `./darknet detector map FaceDetecDataset_subV1/obj.data yolov4-FaceDetec_test.cfg FaceDetecDataset_subV1_backup/yolov4-FaceDetec_train_best.weights`

```
200
detections_count = 2835, unique_truth_count = 608
class_id = 0, name = face, ap = 88.30% (TP = 529, FP = 133)

for conf_thresh = 0.25, precision = 0.80, recall = 0.87, F1-score = 0.83
for conf_thresh = 0.25, TP = 529, FP = 133, FN = 79, average IoU = 61.84 %

IoU threshold = 50 %, used Area-Under-Curve for each unique Recall
mean average precision (mAP@0.50) = 0.882951, or 88.30 %
Total Detection Time: 7 Seconds
```

PROCESANDO UNA IMAGEN

- `./darknet detector test FaceDetecDataset_subV1/obj.data yolov4-FaceDetec_test.cfg FaceDetecDataset_subV1_backup/yolov4-FaceDetec_train_best.weights FaceDetecDataset_subV1/images/val/0a32de8598733c17.jpg`



PROCESANDO UN VIDEO

- `./darknet detector demo FaceDetecDataset_subV1/obj.data yolov4-FaceDetec_test.cfg FaceDetecDataset_subV1_backup/yolov4-FaceDetec_train_best.weights /home/fcoj23/videos_CD/office.avi -out_filename /home/fcoj23/videos_CD/face_detec_office.avi`



GRACIAS POR SU ATENCIÓN

Francisco J. Hernández López

fcoj23@cimat.mx

WebPage:

www.cimat.mx/~fcoj23

