

DEEPLESION: AUTOMATED MINING OF LARGE-SCALE LESION ANNOTATIONS AND UNIVERSAL LESION DETECTION WITH DEEP LEARNING 실습

<http://yanke23.com/articles/research/2018/06/13/DeepLesion-dataset-CVPR-2018.html>

소스 : https://github.com/rsummers11/CADLab/tree/master/lesion_detector_3DCE

GPU 서버 세팅

- 테스트 서버 사양
 - OS : centos 7.4
 - GPU : Geforce 980Ti
 - Mem : 32GB
- 세팅 순서
 - 1) Docker 설치
 - 2) GPU에 맞는 NVIDIA Driver 설치
 - 3) nvidia-docker 설치
 - 4) NVIDIA GPU cloud에서 mxnet py2 용 Docker 이미지 다운로드
 - 5) Mxnet 이미지에 jupyter 추가



Docker 설치

- <https://docs.docker.com/install/linux/docker-ce/centos/>
- Uninstall old versions

```
$ sudo yum remove docker \
    docker-client \
    docker-client-latest \
    docker-common \
    docker-latest \
    docker-latest-logrotate \
    docker-logrotate \
    docker-selinux \
    docker-engine-selinux \
    docker-engine
```

- Install using the repository

```
$ sudo yum install -y yum-utils \
    device-mapper-persistent-data \
    lvm2
```

```
$ sudo yum-config-manager \
    --add-repo \
    https://download.docker.com/linux/centos/docker-ce.repo
```

```
$ sudo yum install docker-ce
```

- Test

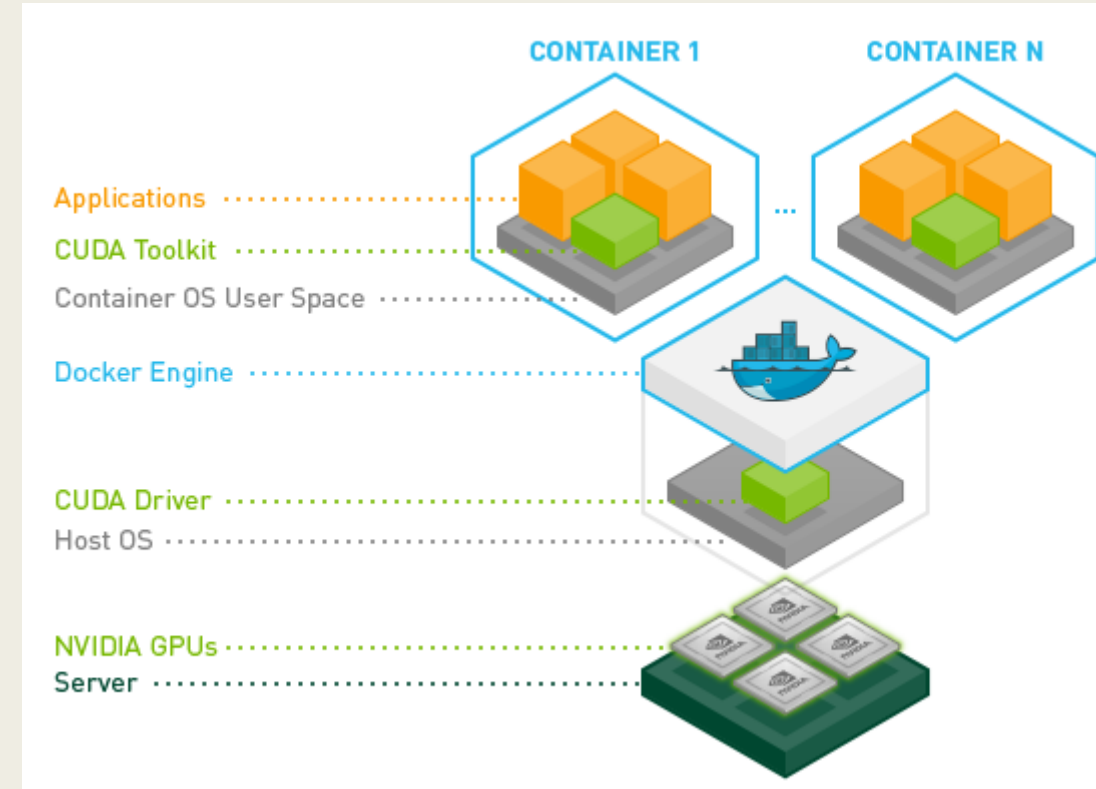
```
$ sudo systemctl start docker
```

```
$ sudo systemctl enable docker
```

```
$ sudo docker run hello-world
```

GPU에 맞는 NVIDIA Driver 설치

- <https://devblogs.nvidia.com/nvidia-docker-gpu-server-application-deployment-made-easy/>
- <https://www.nvidia.com/Download/index.aspx?lang=en-us> 에서 GPU 종류와 OS에 종류에 따른 드라이버 다운로드



GPU에 맞는 NVIDIA Driver 설치

```
# Disable Nouveau Driver
$ cat <<EOT >> /etc/modprobe.d/blacklist.conf
blacklist nouveau
EOT
```

```
$ mv /boot/initramfs-$(uname -r).img /boot/initramfs-$(uname -r).img.bak
$ dracut -v /boot/initramfs-$(uname -r).img $(uname -r)
$ yum update -y
$ reboot
```

```
# Set Up the Operating System and Kernel
$ yum install -y flex gcc gcc-c++ redhat-rpm-config strace \
  rpm-build make pkgconfig gettext automake \
  gdb bison libtool autoconf gcc-c++ gcc-gfortran \
  binutils rcs patchutils wget
```

```
$ yum install -y kernel-devel-`uname -r`
```

```
# Install the NVIDIA Driver on GPU Nodes
$ export NVIDIA_DRIVER_VERSION=390.67
$ wget http://us.download.nvidia.com/XFree86/Linux-x86_64/390.67/NVIDIA-Linux-x86_64-${NVIDIA_DRIVER_VERSION}.run
$ chmod 755 ./NVIDIA-Linux-x86_64-${NVIDIA_DRIVER_VERSION}.run
$ ./NVIDIA-Linux-x86_64-${NVIDIA_DRIVER_VERSION}.run -asq
```

```
$ /usr/bin/nvidia-smi
```

```
[root@cdsw tools]# /usr/bin/nvidia-smi
Sun Nov 25 17:54:16 2018

+-----+
| NVIDIA-SMI 390.77                Driver Version: 390.77                |
+-----+-----+
| GPU Name Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf  Pwr:Usage/Cap|      Memory-Usage | GPU-Util  Compute M. |
|=====+=====+=====+
|   0  GeForce GTX 980 Ti  Off   | 00000000:01:00.0 Off  |          N/A   |
|  0%   35C    P0      51W / 300W |  0MiB /  6083MiB |      0%      Default |
+-----+-----+

+-----+
| Processes:                                     GPU Memory |
|  GPU       PID    Type    Process name                        Usage      |
|=====+=====+
| No running processes found                  |
+-----+
```

nvidia-docker 설치

- <https://github.com/NVIDIA/nvidia-docker>

- 사용하는 이유

- CUDA 와 CUDNN 을 버전 에
필요 없음.
- CUDA 와 CUDNN 의 다양한 버
음

Enable Docker NVIDIA Volumes on GPU Node

\$ wget https://github.com/NVIDIA/nvidia-docker/releases/download/v1.0.1/nvidia-docker-1.x86_64.rpm

\$ yum install -y nvidia-docker-1.0.1-1.x86_64

\$ systemctl start nvidia-docker

\$ systemctl enable nvidia-docker

\$ nvidia-docker run --rm nvidia/cuda:9.1-cudnn7-runtime nvidia-smi

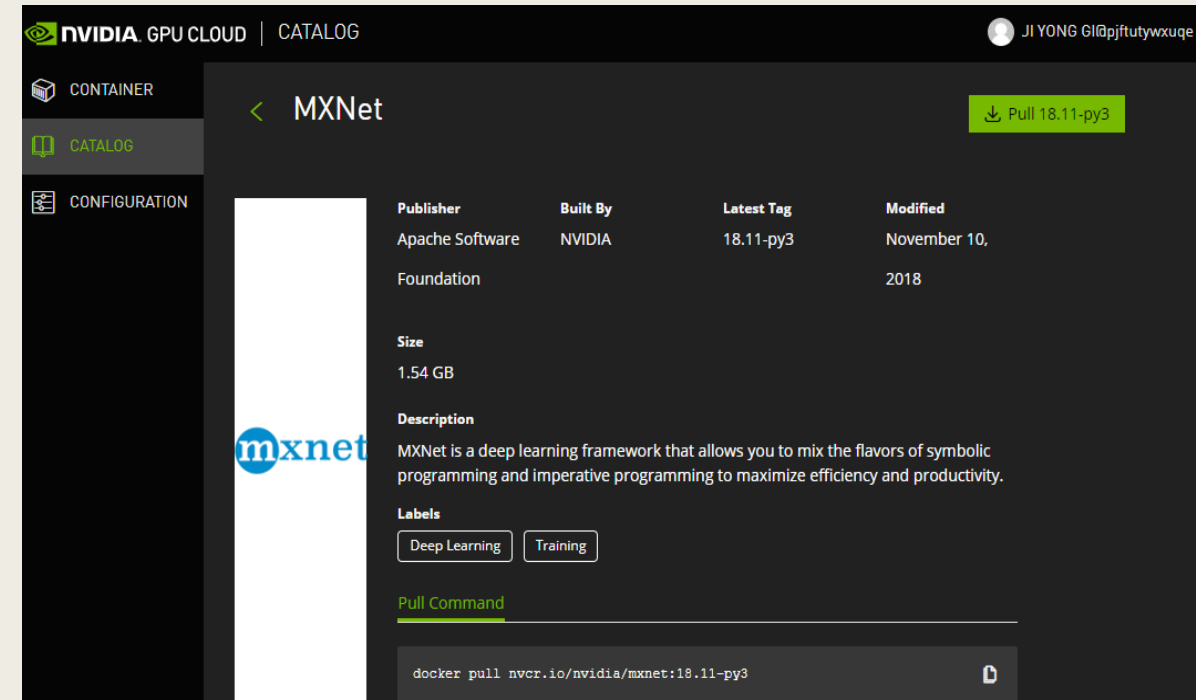
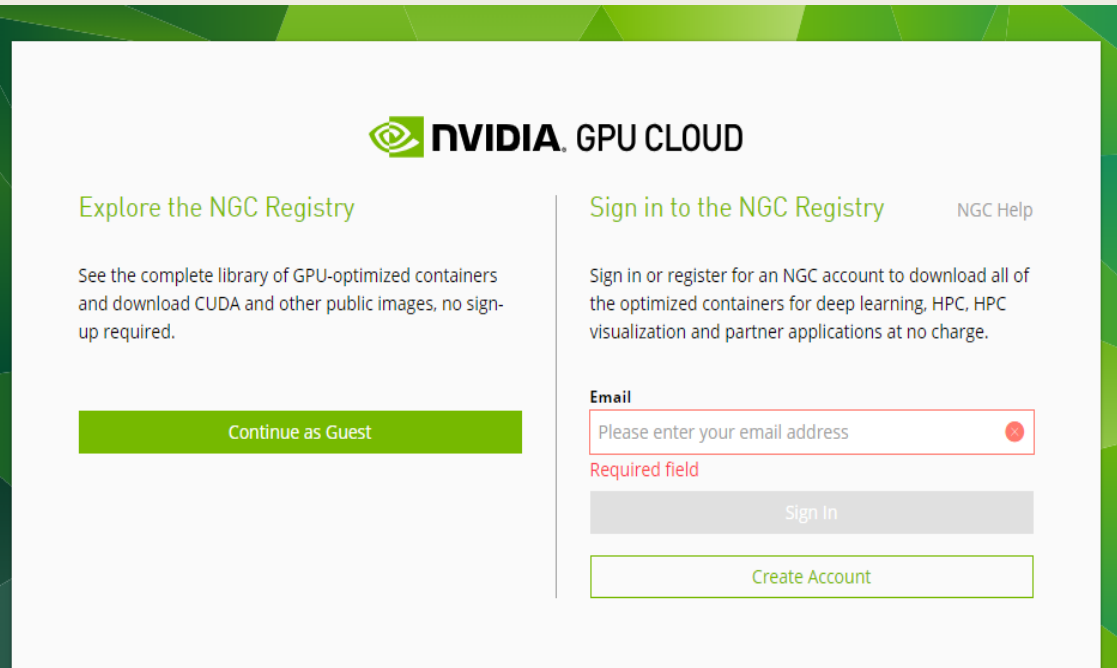
```
[root@cdsw tools]# nvidia-docker run --rm nvidia/cuda:9.1-cudnn7-runtime nvidia-smi
Unable to find image 'nvidia/cuda:9.1-cudnn7-runtime' locally
nvidia/cuda:9.1-cudnn7-runtime: Pulling from nvidia/cuda
18d680d61657: Pull complete
0addb6fece63: Pull complete
78e58219b215: Pull complete
eb6959a66df2: Pull complete
ec55825c3d11: Pull complete
15afc0d212f9: Pull complete
5ead56729c9f: Pull complete
cfc9b2783b7c: Pull complete
86d09c468e38: Pull complete
Digest: sha256:e062a7376503692325393fb5c0ee73a74f1eabc3298fbbc29c61bb14b442cc66
Status: Downloaded newer image for nvidia/cuda:9.1-cudnn7-runtime
Sun Nov 25 09:03:24 2018
```

NVIDIA-SMI 390.77		Driver Version: 390.77					
GPU	Name	Persistence-M	Bus-Id	Disp.A	Volatile	Uncorr.	ECC
Fan	Temp	Perf	Pwr:Usage/Cap	Memory-Usage	GPU-Util	Compute	M.
0	GeForce	GTX 980 Ti	Off	00000000:01:00.0	Off		N/A
0%	35C	P0	51W / 300W	0MiB / 6083MiB	0%		Default

Processes:				GPU Memory
GPU	PID	Type	Process name	Usage
No running processes found				

NVIDIA GPU cloud에서 mxnet py2용 Docker 이미지 다운로드

- <https://ngc.nvidia.com/>
- docker login nvcr.io
- Username: \$oauthtoken
- Password: dGI0ajBhXXXXXXXXXXXXXXXXXXXXXXXXXXXX
- docker pull nvcr.io/nvidia/mxnet:18.11-py3



```
[root@cdsw ~]# docker login nvcr.io
Username ($oauthtoken): $oauthtoken
Password:
Login Succeeded
[root@cdsw ~]# docker pull nvcr.io/nvidia/mxnet:18.04-py2
18.04-py2: Pulling from nvidia/mxnet
f2233041f557: Pull complete
f321bcc6a76c: Pull complete
2f25d8d1d058: Pull complete
87bfe0d2f0e8: Pull complete
145c1bf7947a: Pull complete
b146afd09c39: Pull complete
daadc0376ab4: Downloading 43.17MB/441.7MB
b35ad3405786: Download complete
a33366ff728e: Download complete
9384272f4e0f: Download complete
7537bf7c96ee: Downloading 41.55MB/225MB
91e40537a771: Download complete
fc54fc28c6ac: Download complete
8916482f2511: Download complete
a839dd4b292e: Download complete
cbe311e8f219: Downloading 1.078MB/207.6MB
d6c58d429a77: Waiting
1e8cbca05768: Waiting
8ed7f16fc955: Waiting
06694f8026e7: Waiting
287952c822bb: Waiting
1a3b7522879b: Waiting
0df0cfe43860: Pulling fs layer
```


Mxnet 이미지에 jupyter 추가

```
# mxnet.18.07-py2.Dockerfile 내용
```

```
FROM nvcr.io/nvidia/mxnet:17.12
```

```
RUN pip --no-cache-dir install Cython ipykernel jupyter path.py Pillow pygments six sphinx wheel zmq  
&& \
```

```
    python -m ipykernel.kernelspec
```

```
# Set up notebook config
```

```
COPY jupyter_notebook_config.py /root/.jupyter/
```

```
# Jupyter has issues with being run directly: https://github.com/ipython/ipython/issues/7062
```

```
COPY run_jupyter.sh /root/
```

```
# Expose Ports for TensorBoard (6006), Ipython (8888)
```

```
EXPOSE 6006 8888
```

```
RUN mkdir work
```

```
WORKDIR "/work"
```

```
CMD ["/root/run_jupyter.run --allow-root"]
```

Mxnet 이미지에 jupyter 추가

■ 이미지 빌드

```
$ docker build -t mycompany.com/nvidia/mxnet:18.07-py2 -f mxnet.18.07-py2.Dockerfile .
```

■ 실행 방법


```
$ nvidia-docker run -it --shm-size=1g --ulimit memlock=-1 --ulimit stack=67108864 -e  
PASSWORD=mypasswd \
```

```
--net=host --pid=host -e TINI_SUBREAPER=true \
```

```
-v /root/CADLab:/root/CADLab \
```

```
mycompany.com/nvidia/mxnet:18.07-py2
```

Mxnet 이미지에 jupyter 추가

 Quit Logout

Files Running Clusters

Select items to perform actions on them. Upload New ▾ 

☐ 0 ▾ / CADLab

Name ▾ Last Modified File size

<input type="checkbox"/> ..	몇 초 전	
<input type="checkbox"/> body_part_regressor	2시간 전	
<input type="checkbox"/> Classify-Rotation-CXR-Frontal-View	2시간 전	
<input type="checkbox"/> CNNSliceClassifier	2시간 전	
<input type="checkbox"/> ColitisDetector	2시간 전	
<input type="checkbox"/> Emphysema_3D_CNN	2시간 전	
<input type="checkbox"/> interleaved_text-image_deep_mining	2시간 전	
<input type="checkbox"/> learning-to-read	2시간 전	
<input type="checkbox"/> lesion_detector_3DCE	한 시간 전	
<input type="checkbox"/> LymphNodeRFCNNPipeline	2시간 전	
<input type="checkbox"/> panreas_hnn	2시간 전	
<input type="checkbox"/> SortDicomFiles	2시간 전	
<input type="checkbox"/> README.md	2시간 전	74 B

소스 다운로드

- <https://github.com/rsummers11/CADLab>
- \$ git clone https://github.com/rsummers11/CADLab.git

90 commits 3 branches 0 releases 7 contributors

Branch: master New pull request Find file Clone or download

Clone with HTTPS ⓘ
Use Git or checkout with SVN using the web URL.
`https://github.com/rsummers11/CADLab.git`

Open in Desktop **Download ZIP**

File	Commit Message	Time
remove old link	remove backup file.	
Classify-Rotation-CXR-Frontal-View	Update README.md	
ColitisDetector	add readme	
Emphysema_3D_CNN	Added code from my summer 2018 project to classify and score emphysema	4 months ago
LymphNodeRFCNNPipeline	Remove old link	2 months ago
SortDicomFiles	Add <body part examined> to README too.	a year ago
body_part_regressor	add self-supervised body-part regressor	8 months ago

소스 소개

- 구현한 frameworks: Faster RCNN, R-FCN, Improved R-FCN [1], 3DCE R-FCN
 - *rcnn/symbol/symbol_vgg.py*
 - *tools/train.py*
- DeepLesion dataset 설명
 - *Load data split and annotations from DL_info.csv (see dataset/DeepLesion.py)*
 - *Load images from 16-bit png files (see fio/load_ct_img.py)*
- CT image들 전처리
 - *슬라이스 간격에 따라 중간 슬라이스를 선형으로 보정*
 - *intensity windowing 작업 수행*
 - *픽셀 간격 표준화*
 - *검은 색 테두리를 자르기*
- 다른 유용한 특징
 - *각각의 epoch 후에 validation set으로 평가. 몇번의 epoch 후에 best model을 사용해서 test set을 평가. (tools/train.py, validate.py, test.py, core/tester.py*
 - *batch size와 iter_size 을 조절 가능*
 - *이전 snapshots (중간결과)를 default.yml 으로 exp_name과 begin_epoch을 설정해서 재계산 가능*
 - *exp_name 이름으로 로그를 남김*

소스 소개

■ 준비물

- MXNet 1.0.0
- Python 2.7
- Before running, run "make" to compile binary files
- To train the universal lesion detector, download the DeepLesion dataset.

■ 디렉토리 구조

- experiment_logs: log files for the results
- images: images used in this readme.
- rcnn: the core codes. The main function is in core/tools/train.py.
- config.yml and default.yml: configuration files to run the code.
- train.sh and test.sh: run these files to train or test.

소스 수정할 부분

■ CADLab/lesion_detector_3DCE/default.yml

- `dataset_path: '/home/yk/research/data/DeepLesion/'`
=> `dataset_path: '/root/data/DeepLesion/'` #실제 데이터가 있는 디렉토리로 지정
- `image_path: '/home/yk/research/data/DeepLesion/Images_png/'`
=> `image_path: '/root/data/DeepLesion/Images_png/'`

추가 설정 사항

- `pip install easydict, PyYAML, matplotlib, scipy, nibabel`
- `sudo apt- install python-tk`
- `wget http://data.dmlc.ml/models/imagenet/vgg/vgg16-0000.params -O vgg16-0000.params`
- `/home/yk/ct/data/imagenet_models/MXNet/vgg16-0000.params` 파일 요구
 - `mkdir -p /home/yk/ct/data/imagenet_models/MXNet/`
 - `cp vgg16-0000.params /home/yk/ct/data/imagenet_models/MXNet/`

1차 시도

```
INFO:root:Epoch 0 Batch 11100 12.5 smp/sec RPNLogLoss=0.198, RPNL1Loss=0.0182, RCNNLogLoss=0.248, RCNNL1Loss=0.0244,
INFO:root:Epoch 0 Batch 11200 14.0 smp/sec RPNLogLoss=0.174, RPNL1Loss=0.0201, RCNNLogLoss=0.26, RCNNL1Loss=0.0245,
INFO:root:Epoch[0] Train-RPNLogLoss=0.175530
INFO:root:Epoch[0] Train-RPNL1Loss=0.014599
INFO:root:Epoch[0] Train-RCNNLogLoss=0.274962
INFO:root:Epoch[0] Train-RCNNL1Loss=0.030397
INFO:root:Epoch[0] Time cost=1751.427 , 30분
Traceback (most recent call last):
  File "/root/CADLab/lesion_detector_3DCE/./rcnn/tools/train.py", line 253, in <module>
    train_net(default)
  File "/root/CADLab/lesion_detector_3DCE/./rcnn/tools/train.py", line 223, in train_net
    begin_epoch=args.begin_epoch, num_epoch=args.e2e_epoch)
  File "/root/CADLab/lesion_detector_3DCE/rcnn/tools/../../rcnn/core/module.py", line 379, in fit
    self.set_params(arg_params, aux_params)
  File "/opt/mxnet/python/mxnet/module/base_module.py", line 652, in set_params
    allow_extra=allow_extra)
TypeError: init_params() got an unexpected keyword argument 'allow_extra'
root@b40b8b3c8f56:~/CADLab/lesion_detector_3DCE#
```

2차 시도

- CADLab/lesion_detector_3DCE/config.yml
 - FRAMEWORK: **'Faster'** # alternatives: 'Faster'(Faster RCNN), 'RFCN', '3DCE'

```
INFO:root:Epoch 0 Batch 10900 12.2 smp/sec RPNLogLoss=0.0534, RPNL1Loss=0.013, RCNNLogLoss=0.236, RCNNL1Loss=0.0888,
INFO:root:Epoch 0 Batch 11000 12.4 smp/sec RPNLogLoss=0.053, RPNL1Loss=0.0129, RCNNLogLoss=0.263, RCNNL1Loss=0.0957,
INFO:root:Epoch 0 Batch 11100 12.3 smp/sec RPNLogLoss=0.0595, RPNL1Loss=0.0142, RCNNLogLoss=0.278, RCNNL1Loss=0.098,
INFO:root:Epoch 0 Batch 11200 12.1 smp/sec RPNLogLoss=0.0527, RPNL1Loss=0.0129, RCNNLogLoss=0.269, RCNNL1Loss=0.0905,
INFO:root:Epoch[0] Train-RPNLogLoss=0.052907
INFO:root:Epoch[0] Train-RPNL1Loss=0.010256
INFO:root:Epoch[0] Train-RCNNLogLoss=0.255415
INFO:root:Epoch[0] Train-RCNNL1Loss=0.085958
INFO:root:Epoch[0] Time cost=1832.222
Traceback (most recent call last):
  File "/root/CADLab/lesion_detector_3DCE/./rcnn/tools/train.py", line 253, in <module>
    train_net(default)
  File "/root/CADLab/lesion_detector_3DCE/./rcnn/tools/train.py", line 223, in train_net
    begin_epoch=args.begin_epoch, num_epoch=args.e2e_epoch)
  File "/root/CADLab/lesion_detector_3DCE/rcnn/tools/../../rcnn/core/module.py", line 379, in fit
    self.set_params(arg_params, aux_params)
  File "/opt/mxnet/python/mxnet/module/base_module.py", line 652, in set_params
    allow_extra=allow_ext)
TypeError: init_params() got an unexpected keyword argument 'allow_extra'
root@b40b8b3c8f56:~/CADLab/lesion_detector_3DCE#
```