

MIGRATING YOUR ML TO CANDLE

HARRY YOO
Software Engineer
Data Science and Learning
Division

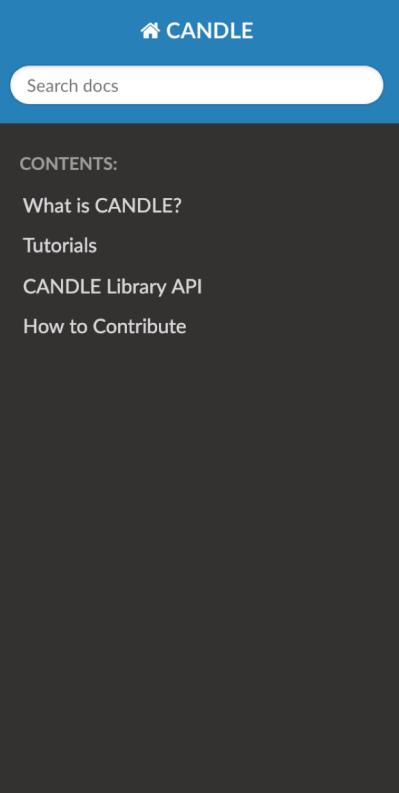
hsyoo@anl.gov
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ECP Annual Meeting

AGENDA

- Documentation Site
- Code Structure
- Parameters
- Custom data loading

DOCUMENTATION

<https://ecp-candle.github.io/Candle/>



The screenshot shows the CANDLE Documentation Home page. At the top, there's a blue header bar with the CANDLE logo and a search bar labeled "Search docs". Below the header, the word "CONTENTS:" is followed by a list of links: "What is CANDLE?", "Tutorials", "CANDLE Library API", and "How to Contribute". To the right of the content area, there's a breadcrumb navigation "Docs » CANDLE Documentation Home" and a link "View page source". The main content area features a large title "CANDLE Documentation Home" and a section titled "Contents:" with a bulleted list of topics.

Docs » CANDLE Documentation Home [View page source](#)

CANDLE Documentation Home

Contents:

- [What is CANDLE?](#)
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 - [How to run CANDLE compliant code in Theta](#)
 - [GA \(genetic algorithm\) based based hyperparameter optimization on CANDLE Benchmarks](#)
 - [Run Asynchronous Search based hyperparameter optimization on CANDLE Benchmarks](#)
 - [Run mlrMBO based hyperparameter optimization on CANDLE Benchmarks](#)
 - [PBT Workflow](#)
 - [Evaluate an Unrolled Parameter File \(UPF\)](#)

CODE STRUCTURE

1. import candle_keras as candle
2. Construct a class extending
candle.Benchmark
3. Implement
 - initialize_parameters
 - run
4. (later) implement data loading for your
data

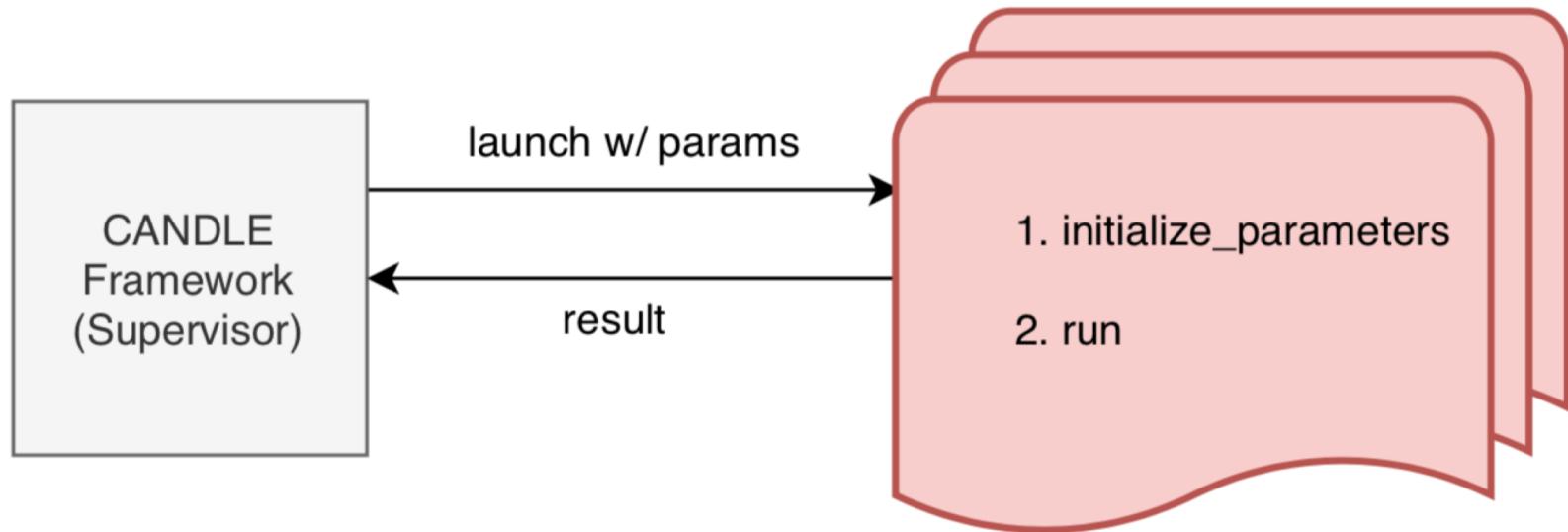
```
mnist.py
class MNIST(candle.Benchmark):
    pass

mnist_mlp_candle.py
def initialize_parameters():
    pass

def run(gParameters):
    pass
```

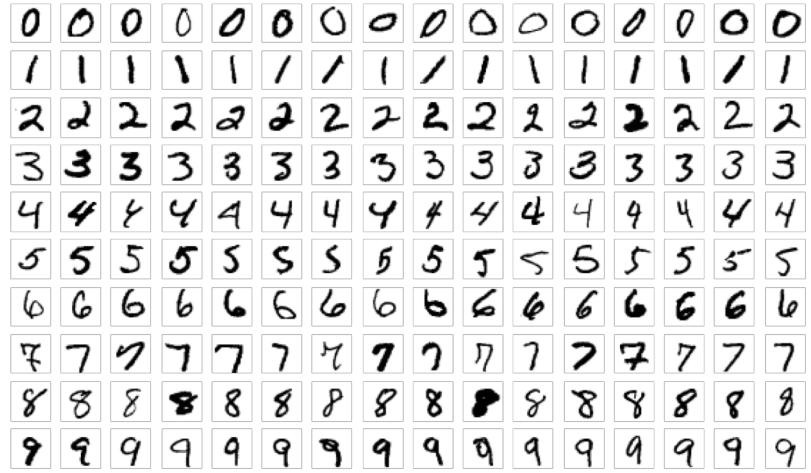
<https://github.com/ECP-CANDLE/Candle/tree/master/examples/mnist>

WHY



ABOUT MNIST

- Handwritten digits (0 – 9)
- 28 x 28 pixels
- 60,000 training, 10,000 test samples
- <http://yann.lecun.com/exdb/mnist/>
- `from keras.datasets import mnist`



MNIST MLP

Layer (type)	Output Shape	s.optimizers	Param #	RMSprop
dense_1 (Dense)	(None, 512)	Adam, batch_size = 128, epochs = 10, validation_split = 0.1, validation_freq = 20	401920	
dropout_1 (Dropout)	(None, 512)		0	
dense_2 (Dense)	(None, 512)		262656	
dropout_2 (Dropout)	(None, 512)		0	
dense_3 (Dense)	(None, 10)		5130	
Total params:	669,706	x_train = x_train.reshape(60000, 28 * 28), x_test = x_test.reshape(10000, 28 * 28)		
Trainable params:	669,706	x_train = x_train.astype('float32'), x_test = x_test.astype('float32')		
Non-trainable params:	0			

https://github.com/ECP-CANDLE/Candle/blob/master/examples/mnist/mnist_mlp.py

MNIST CNN

Layer (type)	Output Shape	Param #
conv2d_1 (Conv2D)	(None, 26, 26, 32)	320
conv2d_2 (Conv2D)	(None, 24, 24, 64)	18496
max_pooling2d_1 (MaxPooling2D)	(None, 12, 12, 64)	0
dropout_1 (Dropout)	(None, 12, 12, 64)	0
flatten_1 (Flatten)	(None, 9216)	0
dense_1 (Dense)	(None, 128)	1179776
dropout_2 (Dropout)	(None, 128)	0
dense_2 (Dense)	(None, 10)	1290

Total params: 1,199,882

Trainable params: 1,199,882

Non-trainable params: 0

MNIST CODE REVIEW

<https://github.com/ECP-CANDLE/Candle/tree/master/examples/mnist>

ECP-CANDLE / Candle

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Branch: master Candle / examples / mnist / Create new file Upload files Find file History

hyoo update complex version of mnist Latest commit c28e531 8 hours ago

..

mnist.py	update complex version of mnist	8 hours ago
mnist_candle.py	update complex version of mnist	8 hours ago
mnist_cnn.py	CANDLE Python Library and MNIST example	9 months ago
mnist_cnn_candle.py	compatible with beta release	8 months ago
mnist_complex.txt	update complex version of mnist	8 hours ago
mnist_mlp.py	CANDLE Python Library and MNIST example	9 months ago
mnist_mlp_candle.py	compatible with beta release	8 months ago
mnist_params.txt	compatible with beta release	8 months ago

HANDS ON

```
(keras) > python mnist_mlp_candle.py
Using TensorFlow backend.
Configuration file: /Users/hsyoo/dev/CANDLE/Candle/examples/mnist/mnist_params.txt
{'activation': 'relu', 'batch_size': 128, 'epochs': 20, 'optimizer': 'rmsprop'}
Params:
{'activation': 'relu',
 'batch_size': 128,
 'datatype': <class 'numpy.float32'>,
 'epochs': 20,
 'experiment_id': 'EXP000',
 'gpus': [],
 'logfile': None,
 'optimizer': 'rmsprop',
 'output_dir': '/Users/hsyoo/dev/CANDLE/Candle/examples/mnist/Output/EXP000/RUN000',
 'rng_seed': 7102,
 'run_id': 'RUN000',
 'shuffle': False,
 'timeout': -1,
 'train_bool': True,
 'verbose': None}
```

PARAMETERS

- Default Parameters
- Add / mandate parameters
- Overwrite parameters as needed

OVERWRITING PARAMETERS

1. Default value defined in CANDLE Library
2. Values defined in default parameter file. e.g. `mnist_params.txt`
3. Parameters file overwritten by `--conf`
4. Individual parameter values provided by argument. e.g. `-e 1`

HANDS ON

- Run without arguments
 - `python mnist_mlp_candle.py`
- Run using model file
 - `python mnist_mlp_candle.py -conf model_complex.txt`
- Run overwriting with argument
 - `python mnist_mlp_candle.py -e 1`
- Let make it more complicated
 - `python mnist_candle.py`

ADDITIONAL PARAMS

- Declare additional parameters in JSON format

```
additional_definitions = [
    {'name':'latent_dim',
     'action':'store',
     'type': int,
     'help':'latent dimensions'},
    {'name':'model',
     'default':'ae',
     'choices':['ae', 'vae', 'cvae'],
     'help':'model to use: ae, vae, cvae'},
    {'name':'use_landmark_genes',
     'type': candle.str2bool,
     'default': False,
     'help':'use the 978 landmark genes from LINCS (L1000) as expression features'},
```

<https://github.com/ECP-CANDLE/Benchmarks/blob/master/Pilot1/P1B1/p1b1.py>



REQUIRED PARAMS

```
74     required = [  
75         'activation',  
76         'batch_size',  
77         'dense',  
78         'drop',  
79         'epochs',  
80         'initialization',  
81         'learning_rate',  
82         'loss',  
83         'noise_factor',  
84         'optimizer',  
85         'rng_seed',  
86         'model',  
87         'scaling',  
88         'validation_split',
```

<https://github.com/ECP-CANDLE/Benchmarks/blob/master/Pilot1/P1B1/p1b1.py>



LOADING DATA

```
def load_data(params, seed):
    drop_cols = ['case_id']
    onehot_cols = ['cancer_type']
    y_cols = ['cancer_type']

    if params['use_landmark_genes']:
        lincs_file = 'lincs1000.tsv'
        lincs_path = candle.fetch_file(params['url_p1b1'] + lincs_file, 'Pilot1')
        df_l1000 = pd.read_csv(lincs_path, sep='\t')
        x_cols = df_l1000['gdc'].tolist()
        drop_cols = None
    else:
        x_cols = None

    train_path = candle.fetch_file(params['url_p1b1'] + params['file_train'], 'Pilot1')
    test_path = candle.fetch_file(params['url_p1b1'] + params['file_test'], 'Pilot1')

    return candle.load_csv_data(train_path, test_path,
                                x_cols=x_cols,
                                y_cols=y_cols,
                                drop_cols=drop_cols,
                                onehot_cols=onehot_cols,
                                n_cols=params['feature_subsample'],
                                shuffle=params['shuffle'],
                                scaling=params['scaling'],
                                dtype=params['datatype'],
                                validation_split=params['validation_split'],
                                return_dataframe=False,
                                return_header=True,
                                seed=seed)
```

Check CANDLE Library API
for more detail

The background of the slide is a grayscale aerial photograph of a large industrial or research facility, likely Argonne National Laboratory. The image shows a complex network of roads, parking lots, and buildings, with a prominent circular structure in the center. The facility is situated in a rural area with fields and trees in the surrounding landscape.

THANKS