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Display Deep Learning Model Training History in Keras

Regression Tutorial with the Keras Deep Learning Library in Python

by Jason Brownlee on June 17, 2016 in [Deep Learning](#), [Multi-Class Classification](#), [Tutorial with the Keras Deep Learning Library](#)

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Last Updated on October 3, 2019

[How to Save and Load Your Keras Deep Learning Model](#)

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- **Update Mar/2017:** Updated for Keras 2.0.2, TensorFlow 1.0.1 and Theano 0.9.0.
- **Update Mar/2018:** Added alternate link to download the dataset.
- **Update Sep/2019:** Updated for Keras 2.2.5 API.
- **Update Oct/2019:** Updated for Keras 2.3.0 API.

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How to Save and Load Your Keras Deep Learning Model

Less Model Training History

Keras provides the capability to register callbacks

One of the default callbacks that is registered when training all deep learning models is the [History callback](#). It records training metrics for each [epoch](#). This includes the loss and the accuracy (for classification problems) as well as the loss and accuracy for the validation dataset, if one is set.

The [Deep Learning with Python](#) EBook is

where you'll find the [Really Good stuff](#). The [history object](#) is returned from calls to the `fit()` function used to train the model. Metrics are stored in a dictionary in the `history` member of the object returned.

[>> SEE WHAT'S INSIDE](#)

For example, you can list the metrics collected in a history object using the following snippet of code after a model is trained:

```
1 ...
2 # list all data in history
3 print(history.history.keys())
```

For example, for a model trained on a classification problem with a validation dataset, this might produce the following listing:

```
1 ['accuracy', 'loss', 'val_accuracy', 'val_loss']
```

We can use the data collected in the history object to create plots.

The plots can provide an indication of useful things about the training of the model, such as:



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- It's speed of convergence over epochs (slope).

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- Whether the model may have already converged (plateau of the line).

 Whether the model may be over-learning the training data (inflection for validation line).

And more.

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Learning Library in Python



Multi-Class Classification Tutorial with the
Keras Deep Learning Library



How to Save and Load Your Keras Deep
Learning Model

Finalize Model Training History

We can create plots from the collected history data

In the example below we create a small network to model the Pima Indians onset of diabetes binary classification problem. This is a small dataset available from the UCI Machine Learning Repository. You can download the dataset and save it as *pima-indians-diabetes.csv* in your current working directory (update: [download from here](#)). The Deep Learning with Python EBook is where you'll find the *Really Good* stuff.

The exam  turned from training the model and creates two charts:
[>> SEE WHAT'S INSIDE](#)

1. A plot of accuracy on the training and validation datasets over training epochs.
2. A plot of loss on the training and validation da

```

2 from keras.models import Sequential
3 from keras.layers import Dense
4 import matplotlib.pyplot as plt
5 import numpy
6 # load pima indians dataset
7 dataset = numpy.loadtxt("pima-indians-diabetes.csv", delimiter=",")
8 # split into input (X) and output (Y) variables
9 X = dataset[:,0:8]
10 Y = dataset[:,8]
11 # create model
12 model = Sequential()
13 model.add(Dense(12, input_dim=8, activation='relu'))
14 model.add(Dense(8, activation='relu'))
15 model.add(Dense(1, activation='sigmoid'))
16 # Compile model

```

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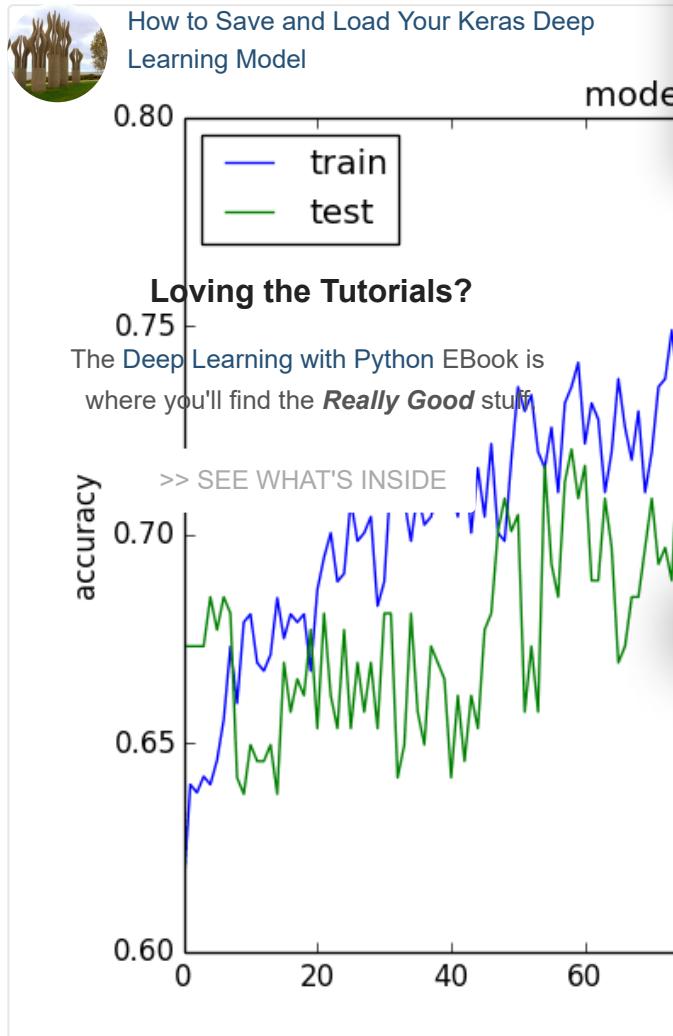
```

17 model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
18 # Fit the model
19 history = model.fit(X, Y, validation_split=0.33, epochs=150, batch_size=10, verbose=0)
20 # list all data in history
21 print(history.history.keys())
22 # summarize history for accuracy
23 plt.plot(history.history['accuracy'])
24 plt.plot(history.history['val_accuracy'])
25 plt.title('model accuracy')
26 plt.ylabel('accuracy')
27 plt.xlabel('Epochs')
28 plt.legend(['train', 'test'], loc='upper left')
29 plt.show()
30 # summarize history for loss
31 plt.plot(history.history['loss'])
32 plt.plot(history.history['val_loss'])
33 plt.title('model loss')
34 plt.ylabel('loss')
35 plt.xlabel('epoch')
36 plt.legend(['train', 'test'], loc='upper left')
37 plt.show()

```

Regression Tutorial with the Keras Deep Learning Library in Python
The history for the training and validation datasets are provided below. The history for the validation dataset includes a test dataset for the model.

From the plot of accuracy we can see that the model is still learning. The accuracy for the training dataset is still rising for the last few epochs, while the validation accuracy has not yet over-learned the training dataset, showing a slight downward trend.



Plot of Model Accuracy on Train and Validation Datasets

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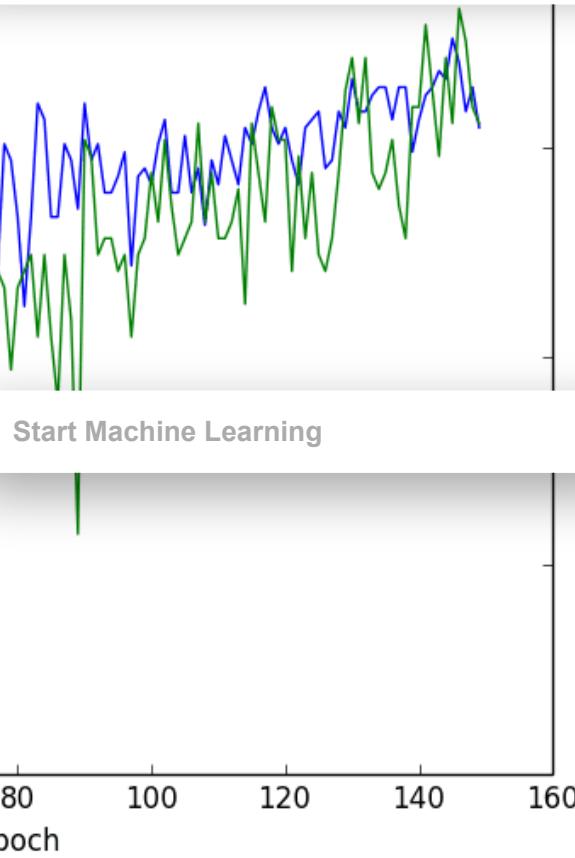
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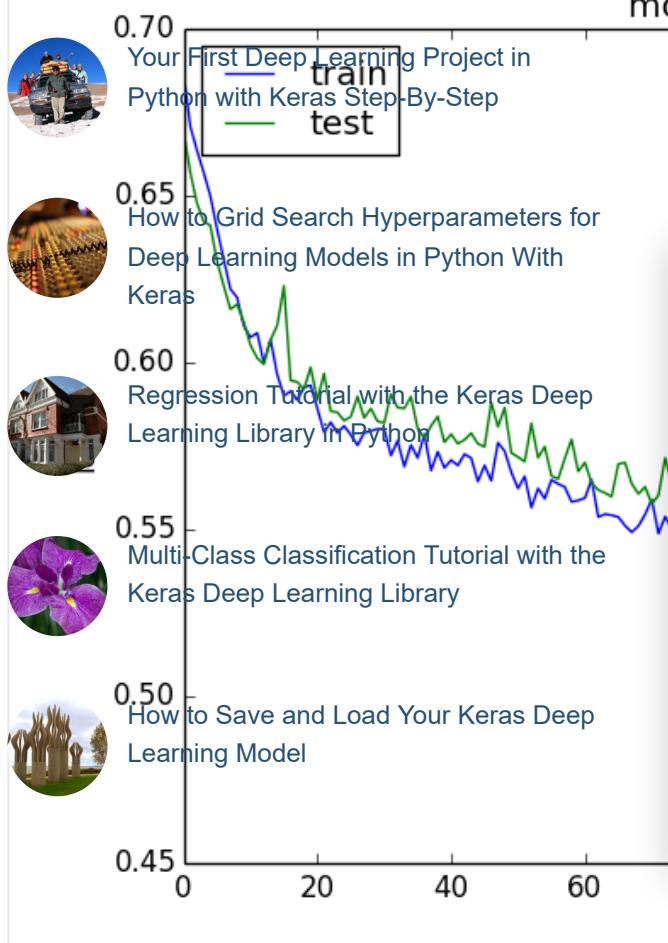
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From the plot of loss, we can see that the model has comparable performance on both train and validation datasets (labeled test). If these parallel plots start to depart consistently, it might be a sign to stop training an earlier epoch.



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Summary

In this post you discovered the importance of collecting and reviewing metrics during the training of your deep learning models.

You learned about the History callback in Keras and how it is always returned from calls to the fit() function to train your models. You learned how to create plots from the history data collected during



Do you have any questions about model training history or about this post? Ask your question in the **Pick a question** section and I will do my best to answer.



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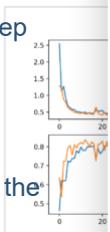


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How to Choose Loss Fu...



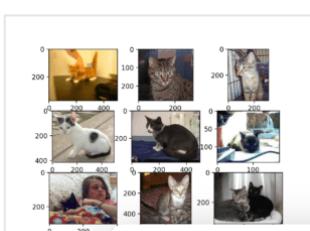
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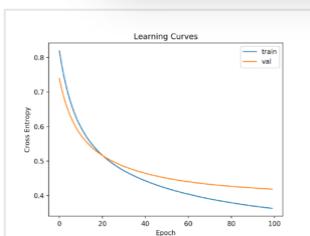
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About Jason Brownlee



Jason Brownlee, PhD is a machine learning specialist who teaches developers how to get results with modern machine learning methods via hands-on tutorials.

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[Dropout Regularization in Deep Learning Models With Keras](#) >



[How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras](#)

262 Responses to *Display Deep Learn*



[Regression Tutorial with the Keras Deep](#)
Marcel August 3, 2016 at 12:12 am #

Thanks Jason!



[Multi-Class Classification Tutorial with the](#)
[Keras Deep Learning Library](#)



Jason Brownlee August 3, 2016 at 8:09

[How to Save and Load Your Keras Deep](#)
[Learning Model](#) You're welcome Marcel.



Dong February 2, 2018 at 2:29 pm #

[REPLY ↗](#)

Loving [the Tutorials?](#) how to use Callback to plot a picture in keras?

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David February 2, 2018 at 4:27 am #
[>> SEE WHAT'S INSIDE](#)

[REPLY ↗](#)

Hi great. Is there also a possibility to plot accuracy and loss for every sample in each epoch.

For instance: 1 epoch, 60,000MNIST images => pl

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Jason Brownlee September 12, 2016 at 8:34 am #

[REPLY ↗](#)

The plots can do this in aggregate, you can calculate the loss and accuracy on each individual sample if you wish, but that would be a lot of data. I hope I have answered your question.



Rochak Agrawal March 4, 2019 at 10:52 pm #

[REPLY ↗](#)

Hi, I was looking for something similar. Did you find a way out ??
Never miss a tutorial:
 Thanks in advance.



Picked for you: July 17, 2020 at 9:40 pm #

REPLY ↗



Your First Deep Learning Project in Python with Keras Step-By-Step

Hi Randy,,

Hope the below code helps, please let me know
[How to Grid Search Hyperparameters for](#)



```
plt.plot(history.history['loss'])
plt.title('RMSE Loss')
plt.xlabel('epoch')
```



Regression Tutorial with the Keras Deep Learning Library in Python

```
for i in range(len(loss)):
    if i%25 == 1:
        print(f'epoch: {i} loss: {loss[i]:.8f}')
```



[Multi-Class Classification Tutorial With the Keras Deep Learning Library](#)



Alvin September 20, 2016 at 9:01 am #

Hi Jason,

Thanks for your great post!

For the accuracy graph, what's the indicator when it starts to get over-learned? What would the graph looks like when it happens?

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October 1, 2016 at 8:01 am #

REPLY ↗

Hi Alvin, great question.

If the model is overfitting the graph will show good performance on the training data, but poor performance on the test data.

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Ajey Pai January 10, 2019 at 9:41 pm #

REPLY ↗

Hi! I am currently training my CNN for my research. The dataset is sparse. I'm using Conv->Conv->Pool->conv->dropout->gap->dense layers.

For many different combinations of the architecture, the model seems to overfit no matter what I do. Is there a methodical way to go about solving this?

Never miss a tutorial!**Jason Brownlee**

January 11, 2019 at 7:45 am #

REPLY ↗



Yes, try adding more regularization.

I have a list of techniques to try here:

<https://machinelearningmastery.com/introduction-to-regularization-to-reduce-overfitting-and-improve-generalization-error/>



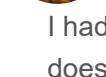
Your First Deep Learning Project in Python with Keras Step-By-Step

**Suny** October 6, 2016 at 3:43 am #

REPLY ↗



How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras



I had a quick question:



does keras support this kind of dataset for implementation?



Regression Tutorial with the Keras Deep Learning Library in Python



regards



Sunny



Multi-Class Classification Tutorial with the Keras Deep Learning Library

**Jason Brownlee** October 6, 2016 at 9:39 pm #

How to Save and Load Your Keras Deep Learning Model



Keras does support autoencoders, but I don't understand how they work. I've seen some examples using MLPs and specialized methods like LSTMs and

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REPLY ↗

Loving the Tutorials?

Yuanliang Meng November 4, 2016 at 2:26 pm #

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where ~~you~~ Jason (~~and all~~) Good stuff.

When dropout is applied. I wonder how the loss and acc values are computed. After each epoch, does the program >> SEE WHAT'S INSIDE < weights to compute the loss and accuracy, or use the whole network?

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REPLY ↗

**Jason Brownlee**

November 5, 2016 at 7:20 am #

Great question,

Dropout is only applied during training (backward pass), not on making predictions (forward pass).

REPLY ↗

**Bo** November 10, 2016 at 10:16 am #

Hi Jason,

Thanks for all of the great tutorials!

Never miss a tutorial:

I'd like to be able to plot the history of a stateful LSTM. I've tried something like the below, but in this case it's failing b/c I'm asking python dicts to do something they don't like (I'm new to python). I've tried some other approaches which have all failed for python-related reasons.

Reprinting your .fit() code from your stateful tutorial (and adding a failed attempt at capturing history):

Picked for you:

```
my_history = {}
in YangE(r$00) Deep Learning Project in
tryPython with Keras Step By Step epoch=1, batch_size=batch_size, verbose=2, shuffle=False)
my_history.update(history)
model.reset_states()
How to Grid Search Hyperparameters for
What am I doing wrong here? Thanks!
Deep Learning Models in Python With
Keras
```

 Regression Tutorial with the Keras Deep Learning Library in Python November 11, 2016 at 9:30 AM Jason Brownlee

Very interesting idea Bo.

 Consider using a list and appending the history of each model to it and keep it all as a Multi-Class Classification Tutorial with the Keras Deep Learning Library

```
1 history_list = list()
2 ...
3 history_list.append(historyDeep)
```

 Learning Model Let me know how you go and what you discover



nagendra somanath December 5, 2016 at 10:52 am #

REPLY ↗

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How can one display the neural net used in keras ? Is there a simple way to plot the network

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>> SEE WHAT'S INSIDE December 6, 2016 at 8:24 am #

REPLY ↗

This might help nagendra:

<https://keras.io/visualization/>

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Aviel December 6, 2016 at 6:13 pm #

REPLY ↗

Hi Jason,

I would like to visualize loss and accuracy graphs per each epoch during training.

I was thinking of doing so by writing a callback but wasn't sure exactly how and if this can be done.

What do you suggest?

Thanks

Never miss a tutorial:**JASON BROWNLEE**

December 7, 2016 at 8:55 am #

REPLY ↗

View thread as [plot](#) designed to do this natively.

Maybe use a callback to post to a file/db and use a separate process to plot?

Picked for you:

I would suggest getting something ghetto like that going and see how it looks.



Your First Deep Learning Project in Python with Keras Step-By-Step

Charlie Parker February 25, 2017 at 5:42 am #

REPLY ↗



How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras

Hi, thanks so much for the tutorial!

I have a quick question. I want to plot the graphs but to [Regression Tutorial with the Keras Deep Learning Library in Python](#) I can't seem to save history object, maybe pickle or standard tool, like rsync or dropbox?

What do you recommend for these remote plotting Multi-Class Classification Tutorial with the Keras Deep Learning Library

(also, can I plot vs iterations instead of epochs? just



How to Save and Load Your Keras Deep Learning Model

Jason Brownlee February 25, 2017 at 6:00 pm #

Hi Charlie,

You can store the history in an array and then create and save the plot as a file, without a display.

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pattijane April 1, 2017 at 10:39 pm #

REPLY ↗

>> SEE WHAT'S INSIDE

I have a very simple question and I hope you don't mind me asking. I want to save loss function figure with plt.savefig("figure"), but I get module is not callable error. everything works just fine. Do you happen to have

Thanks a lot!

**Jason Brownlee**

April 2, 2017 at 6:28 am #

REPLY ↗

Ensure you have matplotlib installed and configured correctly.

pattijane May 12, 2017 at 5:57 am #

REPLY ↗

Never miss a tutorial!

I solved the error, thanks! I have another issue however, I'm doing a grid search on (batch size) and for each combination I plot the loss function. However, for each combination it just keeps displaying each results on top each other in the same figure!

Any idea why that might happen?

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Jason Brownlee

May 12, 2017 at 7:50 am #

REPLY ↗



Sorry, I don't have experience capturing history within a grid search.

How to Grid Search Hyperparameters for
Deep Learning Models and Writing your own for
Keras



Regression Tutorial with the Keras Deep
Learning Library in Python

Hi,



at Multi-Class Classification Tutorial with the
Keras Deep Learning Library
quick question. I am using tensorflow without Keras
accuracy of a CNN. I am using cross entropy with a
loss. Is this right?



How to Save and Load Your Keras Deep
Learning Model
if the loss is in the 200-300 range, should I be
loss is between 0-1.

Thanks

Dave

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REPLY ↗

Hello, thank you for all the great information. Can you provide any suggestions on how to access >> SEE WHAT'S INSIDE << keras model is part of a pipeline?

Thank you,

Caleb

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Jason Brownlee April 28, 2017 at 7:33 am #

REPLY ↗

Sorry, I have not done this myself. You may need to extend the sklearn wrapper and capture this information manually.



Anastasios Selalmazidis May 2, 2017 at 1:01 am #

REPLY ↗

Hi Jason,

I am running this example from your book, but I am using cross_validation in particular StratifiedKFold.

Never miss a tutorial: So when I fit the model I do not pass a validation_split or validation_data hence my model

history has only keys ['acc', 'loss']. I am using model.evaluate(). How can I visualize the test ?



Picked for you:



Jason Brownlee May 2, 2017 at 6:00 am #

REPLY ↗

Your First Deep Learning Project in

Python With Keras Step-By-Step
on each cross validation fold.



How to Grid Search Hyperparameters for
Deep Learning Models in Python With

Nir June 4, 2017 at 8:39 pm #



Hi Jason!

Regression Tutorial with the Keras Deep
Learning Library in Python

When setting verbose to 2, i expect printing during
the train and validation loss (without seeing the acc



The Multi-Class Classification Tutorial with the
Keras Deep Learning Library

KeyError: 'acc'

Exception ignored in: <bound method BaseSession.
How to Save and Load Your Keras Deep
Learning Model



C:\ProgramData\Anaconda3\lib\site-packages
del

UnboundLocalError: local variable 'status' referenced

thanks !

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Jason Brownlee June 5, 2017 at 7:41 am #

REPLY ↗

>> SEE WHAT'S INSIDE

want a progress bar set verbose=1.

You must add the accuracy metric to the fit function. The error suggests this was not done. Learn
more about metrics here:

<https://keras.io/metrics/>

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Nir June 6, 2017 at 2:37 am #

REPLY ↗

Hi Jason, thanks a lot, I still have a few more questions:

- How can I plot the ROC curve using history object?
- How can I save best model after each epoch? (overwrite my model with a new one only if the accuracy over the validation set has improved)

Thanks,
Nir

Never miss a tutorial:

Jason Brownlee June 6, 2017 at 10:07 am #

REPLY ↗

I do not have an example of plotting the ROC curve with Keras results.

Picked for you: This post will help you save models during training:

<http://machinelearningmastery.com/check-point-deep-learning-models-keras/>

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Troy March 23, 2018 at 1:28 pm #

REPLY ↗

How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras



Regression Learning

```

1 from sklearn import metrics
2 import pandas as pd
3 from ggplot import *
4 library in Python
5 #note in keras model.predict()
6 pred_prob = model.predict(Xt)
7
8 #preds = clf.predict_proba(Xt)
9 ; classification threshold with metrics
10 roc_auc = metrics.auc(fpr, tp)
11
12
13 # method I: plt
14 import matplotlib.pyplot as plt
15 plt.title('Receiver Operating
16 plt.plot(fpr, tpr, 'b', label
17 plt.legend(loc = 'lower right'
18 plt.plot([0, 1], [0, 1], 'r--'
19 plt.xlim([0, 1])
20 plt.ylim([0, 1])
21 plt.ylabel('True Positive Rate')
22 plt.xlabel('False Positive Rate')
23

```

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Forgot to say many thanks to you Jason, you never cease to amaze, always on the cutting edge but remaining practical.

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Jason Brownlee March 24, 2018 at 6:18 am #

I'm glad to hear it.



shreyas October 1, 2019 at 5:48 pm #

REPLY ↗

i was facing the same issue of keyerror 'acc'. i have added the accuracy metric in model evaluation still im facing the same error. please help

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ownlee October 2, 2019 at 7:52 am #

REPLY ↗

Change 'acc' to 'accuracy', I believe this is a change in the new version of Keras.

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Your First Deep Learning Project in Python with Keras Step By Step
Mirza Montasir Ali June 8, 2017 at 7:40 am #

REPLY ↗

Can you please tell how can I keep the history of classifier.fit_generator() function.



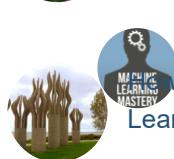
How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras
Arbish June 13, 2017 at 6:37 am #



Regression Tutorial with the Keras Deep Learning Library in Python
Hi Jason!



Multi-Class Classification Tutorial with the Keras Deep Learning Library
Jason Brownlee June 13, 2017 at 8:30 am #



How to Save and Load Your Keras Deep Learning Model
Sorry, I don't have an example.



Kunal Sarkar July 4, 2017 at 8:14 pm #

REPLY ↗

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Hi Jason, I am using more than 100 gb dataset for building a model. where i am using HDF5 data base for data loading so for this type of configuration I am manually iterate the training process. So as I am using manual iteration. History file is not appending the model information, instade of history file is creating after every epoch. How to update history file as it append in normal process.
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can I run >> SEE WHAT'S INSIDE information after every epoch.as history file information is needed for model optimization.

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Jason Brownlee July 6, 2017 at 10:15 am #

REPLY ↗

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Linlin July 7, 2017 at 8:08 am #

REPLY ↗

Hi Jason, I wrote an LSTM model to train my brain MRI slices. For my dataset, each patient has 50 slices, and n patients are divided into training and validation sets. My LSTM model is designed as below:

```
model = Sequential()
```

Never miss a tutorial:

```
model.add(LSTM(128, input_shape = (max_timesteps, num_clusters), activation='tanh',
```

```
recurrent_activation='lu', return_sequences = False, stateful = False, name='lstm_layer'))
```

```
model.add(Dropout(rate=0.5, name='dropout_layer'))
```

```
model.add(Dense(out_category, activation = 'softmax', name='dense_layer'))
```

Picked for you:

```
optimizer = optimizers.RMSprop(lr=lrate)
```

```
model.compile(loss = 'categorical_crossentropy', optimizer = optimizer, metrics=['accuracy'])
```

[Model Your First Deep Learning Project Data](#)(X_vald, y_vald), epochs = epoch_num, batch_size = batch_size, shuffle=True)

[Python Deep Learning Step-By-Step](#)

[Python Deep Learning Step-By-Step](#)

[How to Grid Search Hyperparameters for](#)

[Deep-Learning Models in Python With](#)

However, the training process is very wired. The accuracy is not increasing at Epoch 46. Could you give some advise about this?

Epoch 40/70

[Regression Tutorial with the Keras Deep Learning Library in Python](#)
407/407 [=====] - 12s - loss: 1.2440 - val_loss: 1.2440 - acc: 0.8512 - val_acc: 0.8512

Epoch 41/70

[Multi-Class Classification Tutorial with the Keras Deep Learning Library](#)
407/407 [=====] - 16s - loss: 1.2281 - val_loss: 1.2281 - acc: 0.8595 - val_acc: 0.8595

[How to Save and Load Your Keras Deep Learning Model](#)
407/407 [=====] - 12s - loss: 1.2281 - val_loss: 1.2281 - acc: 0.8678 - val_acc: 0.8678

1.2545 - val_acc: 0.8760

Epoch 44/70

407/407 [=====] - 25s - loss: 2.5658e-07 - acc: 1.0000 - val_loss: 1.2440 - val_acc: 0.8595

Loving the Tutorials?

Epoch 45/70

407/407 [=====] - 25s - loss: 6.2594e-07 - acc: 1.0000 - val_loss: 1.2281 - val_acc: 0.8678

Where you find the **Really Good** stuff.

Epoch 46/70

407/40 >> SEE WHAT'S INSIDE ===== - 25s - loss: 3.3054e-07 - acc: 0.5676 - val_loss: 1.1921e-07 - val_acc: 0.5372

Epoch 47/70

407/407 [=====] - 25s - loss: 1.1921e-07 - acc: 0.5061 - val_loss: 1.1921e-07 - val_acc: 0.5372

Epoch 48/70

407/407 [=====] - 25s - loss: 1.1921e-07 - acc: 0.5061 - val_loss: 1.1921e-07 - val_acc: 0.5372

Epoch 49/70

407/407 [=====] - 25s - loss: 1.1921e-07 - acc: 0.5061 - val_loss: 1.1921e-07 - val_acc: 0.5372

Epoch 50/70

407/407 [=====] - 25s - loss: 1.1921e-07 - acc: 0.5061 - val_loss: 1.1921e-07 - val_acc: 0.5372

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Never miss a tutorial! Jason Brownlee July 9, 2017 at 10:33 am #

REPLY ↗

 pc might give you some ideas:
<http://machinelearningmastery.com/improve-deep-learning-performance/>

Picked for you:

 Your First Deep Learning Project in Python with Keras Step-By-Step Jared August 3, 2017 at 12:05 am #

REPLY ↗

Hi Professor,

 What's your experience with Tensorboard callbacks to plot accuracy? How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras

attempting to use it right now however for some reason I'm not able to implement it. When I comment the callback out, the accuracy is still plotted. Should I just stick to your method instead of using TensorBoard?

 Regression Tutorial with the Keras Deep Learning Library in Python

 Jason Brownlee August 3, 2017 at 6:51 am # Multi-Class Classification Tutorial with the Keras Deep Learning Library TensorBoard Jason Brownlee

 How to Save and Load Your Keras Deep Learning Model Geethu August 1, 2021 at 8:14 am #

How can we see the inside of how the loss function is calculated?

Loving the Tutorials?

 Jason Brownlee August 2, 2021 at 4:51 am # The Deep Learning with Python EBOOK is

REPLY ↗

where you'll find the **Really Good** stuff.

Not sure what you mean sorry. You can calculate these things manually if you like

>> SEE WHAT'S INSIDE ns made by the model.



Navid August 17, 2017 at 8:57 pm #

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Hi,
 Thank you,

How can I have this plots during training? so I can see the network progress online.



Jason Brownlee August 18, 2017 at 6:17 am #

REPLY ↗

Perhaps you could create a custom callback that dynamically updates a graph.

Never miss a tutorial:

Dinh August 18, 2017 at 8:21 pm #

REPLY ↗



Thanh for nice tutorial. I have two questions needed you to make it clear:

1. How can avoid from history object returned by compile function printed.

2. How can I change tensorflow instead of using theano.

Picked for you:

Thank you so much.

Your First Deep Learning Project in Python with Keras Step-By-Step



Jason Brownlee August 19, 2017 at 6:18 am #

REPLY ↗

How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras

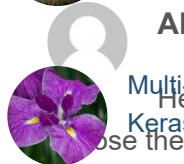
Sorry, I don't understand your first question

Keras

You can change your backend by editing the Keras



Regression Tutorial with the Keras Deep Learning Library in Python



Multi-Class Classification Tutorial with the Keras Deep Learning Library

Hello Dr. Jason , that helped me a lot to visualize the validation split value ?? and batch size



How to Save and Load Your Keras Deep Learning Model

Jason Brownlee September 18, 2017 at 10:56 pm #

Use trial and error on your specific data

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Ahmed Saeed September 18, 2017 at 10:56 pm #

REPLY ↗

The Deep Learning with Python EBook is

where you'll find ~~Excellent~~ Good stuff

I mean by the trial and error ?? I am a newbie I the ML and DL S:

[>> SEE WHAT'S INSIDE](#)



Jason Brownlee September 19, 2017 at 7:45 am #

REPLY ↗

[Start Machine Learning](#)

Sorry, I mean use experiment type of search process.



John William September 18, 2017 at 10:59 pm #

REPLY ↗

What does Val_acc is higher than the actual acc of training ??? Does it mean overfitting or what ?

Never miss a tutorial:**Jason Brownlee** September 19, 2017 at 7:45 am #

REPLY ↗



the it is usual and it may be a sign of underfitting (e.g. an unstable model).

Picked for you:**Raktim** September 27, 2017 at 8:21 pm #

REPLY ↗

[Python with Keras Step-By-Step](#)

Why you have written "Test" in the graph although you use this as a validation?



[How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras](#) **Jason Brownlee** September 27, 2017 at

Nice catch.



[Regression Tutorial with the Keras Deep Learning Library in Python](#)



iman October 17, 2017 at 11:40 am #
[Multi-Class Classification Tutorial with the Keras Deep Learning Library](#)

in its perfect time



but if i want to save it to *.png file how can i do that
i used plt.savefig('iman.png')

[How to Save and Load Your Keras Deep Learning Model](#)

it doesn't work

you help me jason?

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**Jason Brownlee** October 17, 2017 at 4:06 pm #

REPLY ↗

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Yes, that is what I would have recommended.

The [Deep Learning with Python](#) EBook is
Why doesn't it work?
where you'll find the **Really Good** stuff.

>> SEE WHAT'S INSIDE

**Astha** November 26, 2017 at 6:56 am #

REPLY ↗

how to do the same for tflearn, I've looked
My model.fit in tflearn doesn't return anything so I get this error:

```
my_history.update(history)
TypeError: 'NoneType' object is not iterable
```

It's be a great help if you can suggest a solution. Thanks!

Start Machine Learning**Jason Brownlee** November 26, 2017 at 7:35 am #

REPLY ↗

Sorry, I do not use tflearn at this stage. I cannot give you good advice.

Never miss a tutorial:

Abhirami November 29, 2017 at 7:59 pm #

REPLY ↗

Hi Jason, Great article!

I have a question. I am training a CNN over 5 epochs, and getting test accuracy of 0.9995 and plotting the training and validation accuracy graph as you've shown. The training accuracy seem to increase from 0 to 0.9995 over the 5 epochs, but the validation accuracy seems almost a constant line at 1.0



[Your First Deep Learning Project in Python with Keras Step-By-Step](#)

(I'm using 100,000 images, of which 20% is used for testing. Of the 80% for training, 20% of that is split for validation and the rest used for training)



[Search Hyperparameters for Deep Learning Models in Python With Keras](#)



Jason Brownlee November 30, 2017 at 8:00 am #

[Regression Tutorial With the Keras Deep Learning Library in Python](#)

Interesting, perhaps the sample for validation is effective?



[Multi-Class Classification Tutorial with the Keras Deep Learning Library](#)



Abhirami Harrai November 30, 2017 at 9:54 pm #

Yes the outcome holds. It could be that validating on 64000 images and validating on 16000. So, it could be that the validation accuracy is higher than the training accuracy. Also, I noticed that training accuracy goes above the validation accuracy plot when I removed one dropout implementation (out of 2) from my model.

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where you're going to learn all the good stuff

REPLY ↗

>> SEE WHAT'S INSIDE Good to explore other configurations of the model and the test harness!



George November 30, 2017 at 10:06 pm #

REPLY ↗

Hi Jason and thanks for your nice posts.

I want to ask you a question on how to interpret these results.

<https://ibb.co/hYyYvG>

<https://ibb.co/dR3DUB>

I am using a network with keras.

I have 2 layers, each of them with 128 units and the final layer with 2 units.

I am using an L2 regularization. I use adam optimizer.

For fitting, I am using 100 epochs, batch_size 32 and validation split 0.3.

Never miss a tutorial:

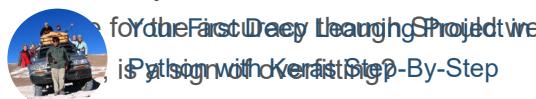
My data consists of 15000 rows with 5 features plus the output.

 I am sure I am fitting or not.

And I can't find out why I have so many fluctuations with my validation data. I tried a lot of different approaches but the fluctuation never goes away.

Picked for you:

Generally, I know that we must not have big gaps/differences between train and validation data. I am not

 for the First Deep Learning Project we always obtain a little better accuracy for the validation data? Python with Keras Step-By-Step

Could you please elaborate on that?

 How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras

 Jason Brownlee December 1, 2017 at 7:15 pm # Regression Tutorial With the Keras Deep Learning Library in Python

Perhaps this post will help diagnose your issue.
<https://machinelearningmastery.com/diagnose-deep-learning-models/>

 Multi-Class Classification Tutorial with the Keras Deep Learning Library

 Ahmed January 22, 2018 at 2:51 pm # How to Save and Load Your Keras Deep Learning Model

Hi Jason,
what about loss and accuracy of object detection problem? In object detection, is it possible to follow same steps?

Loving the Tutorials?

 Jason Brownlee January 23, 2018 at 7:49 am # The Deep Learning with Python EBook Is

REPLY ↗

where you'll find the **Really Good** stuff.
Sorry, I don't follow, can you rephrase or perhaps provide more context?

>> SEE WHAT'S INSIDE



Ashima January 30, 2018 at 8:12 pm #

REPLY ↗

Jason,

I wish to have the average of the errors generated during my training as well so that once I start running the model on my validation set I can compare the error generated at each step with this average that I have. How is it possible to get this average RMSE value for the entire training data



Jason Brownlee January 31, 2018 at 9:41 am #

REPLY ↗

Not sure I follow, sorry. Perhaps you can give more context?

Never miss a tutorial:

February 26, 2018 at 10:24 pm #

REPLY ↗



Hi.

Thanks. I would like to know : why is the training loss not as good as validation loss at the beginning ? Is it because of the dropout used ?

Picked for you:[Your First Deep Learning Project in](#)[Python with Keras Step-By-Step](#)**Jason Brownlee**

February 27, 2018 at 6:26 am #

REPLY ↗

[It could be](#)
[How to Grid Search Hyperparameters for](#)[Deep Learning Models in Python With](#)[Keras](#)[stan](#) March 3, 2018 at 2:59 pm #
[Regression Tutorial with the Keras Deep](#)[Learning Library in Python](#)[If it is a Plot of Model Loss on Training and](#)[Multi-Class Classification Tutorial with the](#)[Keras Deep Learning Library](#)**Jason Brownlee** March 4, 2018 at 6:00 am #[How to Save and Load Your Keras Deep](#)[Learning Model](#)

Does that help?

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REPLY ↗

The Deep Learning with Python Book did not show the test in the plot, i dont know why.. can you please help me? where you find the **Really Good** stuff.

>> SEE WHAT'S INSIDE

**James Carmichael**

May 23, 2022 at 10:44 am #

REPLY ↗

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Hi manel...Are you receiving a

**Fabrício Melo**

March 4, 2018 at 10:29 pm #

REPLY ↗

Hi, Jason!

How can I plot accuracy versus batch size during the Model Training in Keras History ?

**Fabrício Melo**

March 4, 2018 at 10:29 pm #

REPLY ↗

Using callback

Never miss a tutorial:**Jason Brownlee** March 5, 2018 at 6:24 am #

REPLY ↗

Picked for you:

Your First Deep Learning Project in Python with Keras Step-By-Step

**Jason Brownlee** March 5, 2018 at 6:23 am #

REPLY ↗



Regression Tutorial with the Keras Deep Learning Library in Python

kelvin March 7, 2018 at 8:40 am #

How to Save and Load Your Keras Deep Learning Model

kelvin March 7, 2018 at 8:43 am #

*shows

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**Jason Brownlee** March 7, 2018 at 3:02 pm #

REPLY ↗

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>> SEE WHAT'S INSIDE

**airrea** April 2, 2018 at 2:57 am #

REPLY ↗

Hi Jason,

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How would that history be studied in a regression model? How could the loss in the training and in the validation set be visualized? In my case, when I do:

```
print(history.history.keys())
```

All I get is two values:

```
dict_keys(['mean_absolute_error', 'loss'])
```

So I am not able to plot the validation set loss. I've fitted and evaluated the model with:

```
history = model.fit(X_train, Y_train, epochs=50, batch_size=30)
```

```
loss_and_metrics = model.evaluate(X_test, Y_test, batch_size=12)
```

Never miss a tutorial:

Jason Brownlee April 2, 2018 at 5:25 am #
Looks good.

REPLY ↗

Picked for you:

Your First Deep Learning Project in Python with Keras Step-By-Step
Sara June 14, 2020 at 6:49 pm #

REPLY ↗

In regression, we can add metrics to the compile step, to get the validation loss, right?



model.compile(loss="mean_absolute_error", metrics=[“mean_squared_error”])
Deep Learning Models in Python With Keras
then:
history.history.keys()



will give:
Regression Tutorial with the Keras Deep Learning Library in Python
val_loss, loss, mean_squared_error, val_mean (loss is the MAE)



then we can plot them.
Multi-Class Classification Tutorial with the Keras Deep Learning Library



MLT June 13, 2018 at 6:30 am #
How to Save and Load Your Keras Deep Learning Model
Hi Jason,

It is a nice article to introduce history in Keras. I have step time series prediction. For example, use last two values: $x(n)=x(n+1), x(n+2)$

y has two values, but history['loss_val'] only one value. If this history['loss_val'] is the sum of the loss of the two hours prediction?

I have checked keras with Python EBook but not find answer for it. Thanks in advance.
where you'll find the **Really Good** stuff.

>> SEE WHAT'S INSIDE



Jason Brownlee June 13, 2018 at 3:03 pm #

REPLY ↗

Good question.

Start Machine Learning

It might be the average or sum loss over the vector output? Just a guess.



rajesh bulla June 18, 2018 at 8:03 pm #

REPLY ↗

can we plot same for testing. that is model.evaluate()



Jason Brownlee June 19, 2018 at 6:30 am #

REPLY ↗

No, there is only history during training.

Never miss a tutorial:



Mahbubur Rub Talha July 1, 2018 at 3:16 pm #

REPLY ↗

Picked for you:

Hi Jason



Your First Deep Learning Project in Python with Keras Step-By-Step

Python with Keras Step-By-Step

...trying to plot model loss and accuracy for my model. In history variable 'loss' and 'val_loss' are exists. But when I try to access 'acc' or 'val_acc' it raises a key error. I printed all keys. Please check



How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras

val_dense_3_loss_1

val_dense_3_loss_2



Regression Tutorial with the Keras Deep

Learning Library in Python

val_dense_3_loss_14

val_dense_3_loss_15

val_dense_3_acc_1

Multi-Class Classification Tutorial with the

Keras Deep Learning Library



val_dense_3_acc_14

val_dense_3_acc_15



How to Save and Load Your Keras Deep

Learning Model

dense_3_loss_1

dense_3_loss_2

.....

dense_3_loss_14

dense_3_loss_15

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dense_3_acc_2

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dense_3_acc_14

dense_>> SEE WHAT'S INSIDE

What i missed ?

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Jason Brownlee July 2, 2018 at 6:21 am #

REPLY ↗

You must add metrics=['accuracy'] when you compile() your model.



Talha July 2, 2018 at 2:33 pm #

REPLY ↗

Thanks for your reply.

Yes, I have added this. Please check my implementation below

Never miss a tutorial:

`model.compile(loss='categorical_crossentropy', optimizer=opt, metrics=['accuracy'])`



One thing, I'm getting `dense_3_acc_n` from `history.history.keys()`. If I take the average of `dense_3_acc_1` to `dense_3_acc_n`, I will get average accuracy. Will it calculate actual accuracy?

Picked for you:

Your First Deep Learning Project in Python with Keras **Jason Brownlee** July 2, 2018 at 3:00 pm #

REPLY ↗



I recommend focusing on 'acc' and 'val_acc' keys.



How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras **vivek** July 16, 2018 at 9:52 pm #



Regression Tutorial with the Keras Deep Learning Library in Python Hi, Jason can you please tell how to plot the `model.save('filename')` command). Because 'history' is not defined'



Multi-Class Classification Tutorial with the Keras Deep Learning Library **Jason Brownlee** July 17, 2018 at 6:18 am #



How to Save and Load Your Keras Deep Learning Model You can only get the graphs by calling

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REPLY ↗



Vivek July 19, 2018 at 7:22 pm #

Hi. Thanks for reply, can you please tell how can I plot test accuracy and loss with training and validation

The Deep Learning with Python EBook is where you'll find the **Really Good** stuff.



>> SEE WHAT'S INSIDE **Jason Brownlee** July 20, 2018 at 5:56 am #

REPLY ↗

Yes, the above tutorial shows you how.

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REPLY ↗



Vivek July 23, 2018 at 8:22 pm #

Hi, but this is for training and validation not for real test data? I want to plot all three validation, training and testing in one graph



Jason Brownlee July 24, 2018 at 6:15 am #

REPLY ↗

You can run the training loop manually, evaluate on each dataset, store the results and plot them all at the end.



Picked for you: Vivek July 24, 2018 at 5:45 pm #

REPLY ↗



Thanks
Your First Deep Learning Project in
Python with Keras Step-By-Step



How to Grid Search Hyperparameters for
Deep Learning Models in Python With
Keras
You're welcome.

REPLY ↗



Regression Tutorial with the Keras Deep
Learning Library in Python
Ann August 3, 2018 at 7:56 pm #



thank you. I have a doubt. My model type
Multi-Class Classification Tutorial with the
Keras Deep Learning Library



How to Save and Load Your Keras Deep
Learning Model
Jason Brownlee August 4, 2018 at 6:03 am #

I have some suggestions here:

<https://machinelearningmastery.com/diagnose-deep-learning-models/>

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REPLY ↗

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cybertramp August 4, 2018 at 6:30 am #

The Deep Learning with Python EBook is
where ~~Thank you for the~~ **Really Good** stuff.

I could
>> SEE WHAT'S INSIDE
thanks to you, I came to understand it.



Jason Brownlee August 5, 2018 at 5:21 am #

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REPLY ↗



Marco August 5, 2018 at 2:57 am #

Hi Jason,

Great tutorial. I was wondering how long it takes for the plot to show after the training epochs finish? I tried it out but it's taking a long time for the plots to show and I only did 2 epochs to speed up the process although I am using it with my own neural network rather than the example shown above.

Thanks so much!
Never miss a tutorial:
 Marco



Picked for you: **Jason Brownlee** August 5, 2018 at 5:35 am #

REPLY ↗

 Your First Deep Learning Project In

Python with Keras Step-By-Step

Ensure you are running the code from the command line, here's how:
<https://machinelearningmastery.com/faq/single-faq/how-do-i-run-a-script-from-the-command-line>

 How to Grid Search Hyperparameters for
Deep Learning Models in Python With
Keras

Marco August 18, 2018 at 6:34 am #

 Regression Tutorial with the Keras Deep
Learning Library in Python

Thanks I was able to get around it it turns out
running the script in the terminal. I ran the
script again.

Multi-Class Classification Tutorial with the
Keras Deep Learning Library

 How to Save and Load Your Keras Deep
Learning Model

I'm happy to hear about your progress!

The terminal/console/shells is all the same.

What do you mean when you say "terminal" exactly?

Loving the Tutorials?

 The Deep Learning with Python EBook is
Boris Yakubchik August 31, 2018 at 6:04 am #

REPLY ↗

Thank you for the writing!

I created a script >> SEE WHAT'S INSIDE plots the accuracy and loss with 1 line of code:

<https://pypi.org/project/keras-hist-graph/>

Install with pip install keras-hist-graph

Then use:

```
from keras_hist_graph import plot_history
```

```
history = model.fit(x, y, ...)
```

```
plot_history(history)
```

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 **Jason Brownlee** August 31, 2018 at 8:17 am #

REPLY ↗

Great, thanks for sharing!

Never miss a tutorial:

Dinos Bachas

October 7, 2018 at 10:25 pm #

REPLY ↗



Thanks a lot for all the excellent tutorials you have provided! They have helped a great deal introducing **Picked for you** world.

I have the following question:
Your First Deep Learning Project in

Python with Keras Step-By-Step

Is there a way to plot the train and validation loss vs the dataset size instead of epoch in Keras?

Let's say I have dataset with N train examples. I would like to know the train and validation loss using 20% of the dataset then 40%,...,then 100% and put the results from all these point on a plot.



How to Grid Search Hyperparameters for
Deep Learning Models in Python With
Keras

use the mean of the train loss with respect to the n epoch?



Regression Tutorial with the Keras Deep
Learning Library in Python

seen that Scikit learn has an example script for
https://scikit-learn.org/stable/auto_examples/model_selection/plo

how a Keras Sequential Model can be used with th



Multi-Class Classification Tutorial with the
Keras Deep Learning Library



How to Save and Load Your Keras Deep
Learning Model

October 8, 2018 at 9:26

You can run an experiment and sum error. Fit a model on each sized dataset, store

Yes, you must write a for loop.

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The Deep Learning with Python EBook is
giuseppe October 18, 2018 at 7:57 pm #

REPLY ↗

...
thanks >> SEE WHAT'S INSIDE

can I draw history in a problem which is not a classification problem?

or in other words a network where I'm not using *_*

thanks

Jason Brownlee October 19, 2018 at 6:04 am #

REPLY ↗

Yes. Any metrics tracked during training can be plotted.



Seb McClay November 3, 2018 at 6:53 am #

REPLY ↗

Hi Jason,

Never miss a tutorial:

I'm really learning a lot from your blog. It's really great.

I have a question regarding the history object when fitting a model in Keras.

In the example above, you use a simple neural network with a number of hidden Dense layers. Since the fit method is called once, the history object is instantiated once and all is good and well.

I'm not sure however how to use the history object in an LSTM layer of the model. When stateful=True, we're running the epochs in a loop, such that fit is called at every loop. How do you use the history object

at [Your First Deep Learning Project in](#)

[Python with Keras Step-By-Step](#)

you have to explicitly keep track of it everytime it's been instantiated... via a dictionary for example?



How to Grid Search Hyperparameters for

Deep Learning Models in Python With

Keras **Jason Brownlee**

November 3, 2018 at 7:15 pm #

Good question.



Regression Tutorial with the Keras Deep

Learning Library in Python

If you run the epochs manually, you can also easily store the results in your own list/lists history ob-



Multi-Class Classification Tutorial with the
Keras Deep Learning Library

Peter Boos

November 14, 2018 at 12:54 am #



Would this be combinable with gridsearch
How to Save and Load Your Keras Deep

Learning Model



Jason Brownlee

November 14, 2018 at 1:12 pm #

No, they would be at odds I think. E.g. evaluating model performance (cross-validation) and reviewing learning curves).

The [Deep Learning with Python](#) Ebook is where you'll find the **Really Good** stuff.



>> SEE WHAT'S INSIDE

November 16, 2018 at 6:05 pm #

REPLY ↗

thanks for this starting point article.

i got tired of adding a new stanza for each metric I whole set of keys present in model.compile(metrics)

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```

1 import matplotlib as mpl
2 import matplotlib.pyplot as plt
3 %matplotlib inline
4
5
6
7 def plot_history(history):
8     keys = history.history.keys()
9     # eprint(keys)
10    for key in filter(lambda k:"val_" not in k,  keys):
11        plt.plot(history.history[key])
12        plt.plot(history.history['val_'+key])
13        plt.title(key)
14        plt.ylabel('key')
15        plt.xlabel('epoch')
```

```

16 plt.legend(['train', 'validation'], loc='upper right')
17 plt.show()
18
19 plot_history(model.fit(x_train, y_train,
20                      epochs=50,
21                      workers = 8, use_multiprocessing=True,
22                      # validation_data=(x_val, y_val),
23                      validation_split=train_val_ratio,
24                      verbose=0
25 ))

```

Your First Deep Learning Project in

Python with Keras Step-By-Step



Jason Brownlee November 17, 2018 at 5:43 am #

How to Grid Search Hyperparameters for

Deep Learning Models in Python With

Thanks for sharing!

Keras



REPLY ↗



Regression Tutorial with the Keras Deep

Learning Library

James November 17, 2018 at 5:45 am #

Thanks for the great article!



Small, either accuracy or loss should be sufficient

for fitting a Deep Learning Model.

However, are there cases where we can't draw a

conclusion about the performance of the model? If

accuracy and loss are plotted against epochs, they will

essentially tell us the same thing?



How to Save and Load Your Keras Deep

Learning Model

Why is it that (at least from my own experience)

accuracy is smoother than that of accuracy against epochs?

Jason Brownlee November 24, 2018 at 6:38 am #

REPLY ↗

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Loss may show overfitting but accuracy may show no effect. In that case, I would want to

The Deep Learning with Python EBook is

see both:

where you'll find the **Really Good** stuff.

Accuracy is more discrete than loss, it will be less smooth.

>> SEE WHAT'S INSIDE



James November 24, 2018 at 1:34 pm #

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In the suggested case where loss shows overfitting but accuracy shows no effect, how would you decide what to do next?



Jason Brownlee November 25, 2018 at 6:51 am #

REPLY ↗

Hmm, I'd rather use a model that does not show overfitting (e.g. to have a more stable model). I'd probably add regularization to reduce the overfit loss. Probably weight regularization and perhaps early stopping.

Never miss a tutorial:

MJ May 11, 2021 at 12:38 pm #

REPLY ↗



might be valuable. You may use other performance metrics such as Recall, Precision, and F1 Score which are also generated by including the keras.metrics suite. You may do something like metrics=['accuracy',tf.keras.metrics.Precision(),

Picked for you:

tf.keras.metrics.Recall(),tf.keras.metrics.TruePositives(),tf.keras.metrics.TrueNegatives(),tf.keras.metrics.FalsePositives() tf keras metrics.FalseNegatives()],
Additionally, you may expand your evaluation criteria by getting the confusion matrix and calculate other metrics such as G-Score, False Positive Rate, and Matthew Correlation Coefficient.



[How to Grid Search Hyperparameters for](#)

[Deep Learning Models in Python With](#)

Jason Brownlee May 12, 2021 at 6:41 am #



Thanks for sharing.

[Regression Tutorial with the Keras Deep Learning Library in Python](#)



Alex April 5, 2019 at 4:30 pm #

[Multi-Class Classification Tutorial with the](#)

[Keras Deep Learning Library](#)

I notice that you use validation and test experiments than test.



Thanks for sharing

[How to Save and Load Your Keras Deep Learning Model](#)



Jason Brownlee April 6, 2019 at 6:41 am #

This is a common question that I answer here:

Loving the Tutorials?

<https://machinelearningmastery.com/faq/single-faq/why-do-you-use-the-test-dataset-as-the-validation-dataset/>

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where you'll find the **Really Good** stuff.

[>> SEE WHAT'S INSIDE](#)

[...read more](#) April 16, 2019 at 11:04 pm #

REPLY ↗



Hi Jason,

I did a test, with different batch sizes: 32,64,128,256,512,1024,2048,4096,8192,16384 models for each batch size giving me 35 models in total. I used Keras history to save 'loss' and 'val_loss' for each model and selected the loss and validation loss for minimum in the validation loss, to avoid overfitting. When I plot the loss, I get roughly a minimum for the 5 models with batch size 1024, but when I plot the validation loss there is no minimum. I find this strange, or is this due to how Keras calculate the loss and val_loss?



Jason Brownlee April 17, 2019 at 6:59 am #

REPLY ↗

What do you mean by "no minimum"?

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REPLY ↩

Ok, it was a bug in my code) Now both the training error and validation error decreases with batch size to a minimum around 1024. But now I discovered another thing, which may be obvious to you and others. I calculate and plot the training and validation error using two

[Your First Deep Learning Project in Python with Keras Step By Step](#)
With the best weights and then calculate the MSE for each model. The val_loss and the MSE for the validation set are identical for all models, but the loss and the MSE for the training set are not, even though they are close. So Keras must calculate the loss and val_loss differently, do [How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras](#)

[Regression Tutorial with the Keras Deep Learning Library in Python](#)
Nice work.

The val loss is averaged across each batch. [Multi-Class Classification Tutorial with the Keras Deep Learning Library](#)

[Franciskus Napitupulu](#) April 24, 2019 at 3:45 pm
How to Save and Load Your Keras Deep Learning Model
Hello Jason,

how can I splitting dataset into train, validate and test?

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[Loving the Tutorials?](#) [Jason Brownlee](#) April 25, 2019 at 8:06 am #

REPLY ↩

The Deep Learning with Python EBook is [here](#). You can use the `train_test_split()` function, learn more here: where you'll find the **Really Good** stuff: <https://machinelearningmastery.com/evaluate-performance-machine-learning-algorithms-python-using/> >> SEE WHAT'S INSIDE

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[Clarisse Cortez](#) April 27, 2019 at 7:17 pm #

Hi Jason! I would like to know how I will be able to get the RMSE of my model through `history.history`?



[Jason Brownlee](#) April 28, 2019 at 6:55 am #

REPLY ↩

Keras does not support RMSE, you can add it here:

<https://machinelearningmastery.com/custom-metrics-deep-learning-keras-python/>

Never miss a tutorial: Samir June 13, 2019 at 5:36 pm #

REPLY ↗



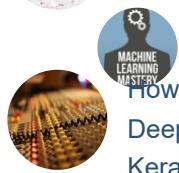
I want to know how can I get gradient info after each epoch while training?

I am using TensorFlow.

Picked for you:



Your First Deep Learning Project in Python with Keras Step-By-Step



Jason Brownlee June 14, 2019 at 6:38 am #

REPLY ↗

How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras
I don't have an example of this, sorry.



Regression Tutorial with the Keras Deep Learning Library in Python

hi jason ,

i run this code but i have this problem " ValueError:



Multi-Class Classification Tutorial with the Keras Deep Learning Library



Jason Brownlee June 30, 2019 at 9:35 a

How to Save and Load Your Keras Deep Learning Model
hear that, I have some suggest

<https://machinelearningmastery.com/faq/single/me>

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X

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ENSAAD ABDELHAK July 6, 2019 at 10:12 pm #

REPLY ↗

The Deep Learning with Python EBook is
How do I see History of my Model after I restart my computer?
where you'll find the **Really Good** stuff.

>> SEE WHAT'S INSIDE



Jason Brownlee July 7, 2019 at 7:51 am #

REPLY ↗

You must save the history to file in order

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sopa July 13, 2019 at 8:30 pm #

REPLY ↗

Hi Jason thanks for your perfect description. 😊

I have a question

I fit my model that my y_train is a list when I plot history like "loss" it doesn't show me anything.
I don't know why. 😕

Never miss a tutorial:**Jason Brownlee** July 14, 2019 at 8:07 am #

REPLY ↗



u can start with the example in the blog post and adapt it to your specific problem?

Picked for you:

Your First Deep Learning Project in Python With Keras Step-By-Step
Vinay July 28, 2019 at 2:13 pm #

REPLY ↗

thank you very much, i am a regular follower of your articles!!! They are amazing.



How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras
Jason Brownlee July 28, 2019 at 6:48 am #



Regression Tutorial with the Keras Deep Learning Library in Python
Thanks!
Jason Brownlee July 28, 2019 at 6:48 am #



Multi-Class Classification Tutorial with the Keras Deep Learning Library
Joe July 31, 2019 at 4:20 pm #

my plot has only 6 epochs and looks like a model accuracy is 99%.



How to Save and Load Your Keras Deep Learning Model
Jason Brownlee August 1, 2019 at 6:44 am #

It suggests the problem you are working on is very simple/easy.

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The Deep Learning with Python EBook is

where you'll find **joe** Really Good stuff
joe August 1, 2019 at 8:05 am #

REPLY ↗

>> SEE WHAT'S INSIDE can i zoom into the graph so it shows the difference in epochs? If we want to use this graph in a paper nobody can see difference from graph.

Start Machine Learning



Jason Brownlee August 7, 2019 at 8:04 am #

REPLY ↗

Perhaps just plot the interval of interest rather than all of the data?



Aymane August 4, 2019 at 6:36 pm #

REPLY ↗

Thanks for your great article, i have a quick question:

I want to know the best epoch for my model (image classification):

1) suppose that i have epoch=4, should i run the model 3 times and consider the last accuracy on validation test (in this case i will 3 values for 3 times), then i pick the highest one ?

2) when i change the epoch should i reapead implement the model or directly fitting it with the new epoch ?

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epoch ?

Thank you in advance.



Picked for you:



Jason Brownlee August 5, 2019 at 6:51 am #

REPLY ↗

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Monitor the validation loss to choose the best epoch.

You can use a checkpoint to save the model for the best validation epoch:

<https://machinelearningmastery.com/check-point-deep-learning-models-keras/>

How to Grid Search Hyperparameters for

Deep Learning Models in Python With Keras

average the chosen number of epochs over mu



Regression Tutorial with the Keras Deep Learning Library in Python

john August 7, 2019 at 6:54 pm #



I have a dataset with over 1 million records. Multi-Class Classification Tutorial with the Keras Deep Learning Library

learn.model_selection.train_test_split? Is it not better to use

test sets?



How to Save and Load Your Keras Deep Learning Model

Jason Brownlee August 8, 2019 at 6:32 pm #

No, see this post:

<https://machinelearningmastery.com/tactics-to-combat-imbalanced-classes-in-your-machine-learning-model/>

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at 1:14 am #

REPLY ↗

>> SEE WHAT'S INSIDE

Hi Jason, thanks for these great tutorials. I run the code above with the data and everything worked well. Now, I'm running the code with a different dataset. I'm training a dataset using model.fit (only training data) and then evaluating the loss values. Then I run model.evaluate on the same training data (no "test_data" as validation) and the loss (a scalar number) I get is different (and usually lower) than the loss value of the last epoch from model.fit. Is this OK? From my understanding of these tutorials, I would have expected both of them to be the same, since the data used in both commands (fit() and evaluate()) is always the same. Is there something about those two commands I'm not getting right?



Jason Brownlee September 6, 2019 at 5:04 am #

REPLY ↗

It is possible that the loss seen during training is averaged over batches within the epoch.

Perhaps check the code or ask on the Keras user group?

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 Tyler September 10, 2019 at 7:56 am #

REPLY ↩

Picked for you:

 Hi Mr. Brownlee, I'm a computer science student working on my final project and I've run into some issues. I have ~4k images over 16 classes, training with a basic network structure; conv starts with 32 filters and doubles at each next conv layer with a kernel size of 3x3 for each conv layer, the dropout rates start at 0.1 and increase by .02-.05 each time. Each class has roughly 250-350 images.

 I use keras image augmentation along with fit_generator to do 500 images per epoch, with 200 total batches for a total of 100k training samples, to make sure that my network is generalizing well I also use augmentation on my validation set. The training loss after 100k samples, however the validation accuracy images leads to terrible results as well.

 Regression Tutorial with the Keras Deep Learning Library in Python
classes are essentially north american animals
a few other random things, so the features that are similar however 30% seems incredibly low. What w

 Multi-Class Classification Tutorial with the Keras Deep Learning Library
t(128,128,3)->sequential->conv->LR->dropout->dropout->BN->conv->LR->dropout->conv->LR->d

 How to Save and Load Your Keras Deep Learning Model

 Jason Brownlee September 10, 2019 at

It sounds like the might may be overfitting.

This will help you diagnose the issue:

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<https://machinelearningmastery.com/learning-curves-for-diagnosing-machine-learning-model-performance/>

The Deep Learning with Python EBook is

where you'll find the [Really Good stuff](#)

[The tutorials here](#) [Will help you](#) correct it:

<https://machinelearningmastery.com/start-here/#better>

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Let me know how you go.

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Tyler September 10, 2019 at 5:27 pm #

REPLY ↩

I appreciate the input, I decided to change to the Resnet architecture and I'm experiencing a similar issue where my val_acc is almost always about half that of my regular acc. After reading over your '7 day mini course' as well as the first link you provided I have come to the conclusion that I don't have enough data to generalize well.

This leads me to a point in which I am not quite sure what to do, I've hand selected the 4k images out of about 100k scraped from google/bing/yahoo and I don't see myself being able to find a meaningful amount of more data. That being said I saw your mention of using noise at the input layer and was wondering what you propose the hard limit is for the value of a Gaussian noise, in your example you have a value of 0.1, is this the most you would recommend?

Never miss a tutorial: Relating to above would the introduction of classes that I do not care about allow for better generalization? An example might be if I had 10 classes pertaining to animals and training led to the issues discussed. Could adding another 10 classes pertaining to random day to day objects allow my model to fit the data better, or perhaps even a single class that is populated by random images of things that are not in the previous 10 classes?

Picked for you:

 Finally, relating to the last paragraph, is it possible to overfit a specific class? Currently my distribution is nearly even, like I said each class has about 250-350 images to train, and 10% of Your First Deep Learning Project in Python with Keras Step-By-Step that to test, would having a class with 2k images in it cause problems with overfitting?

 Thanks for all your time, unfortunately my capstone adviser isn't knowledgeable in this area so I'm learning as I go and your website has been very helpful.

How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras

 **Tyler** September 10, 2019 at 5:32 pm
Regression Tutorial with the Keras Deep Learning Library in Python You can ignore my final quest <https://machinelearningmastery.com/tensorflow-deep-learning-dataset/>.

 Multi-Class Classification Tutorial with the Keras Deep Learning Library I would still appreciate some input on t

 How to Save and Load Your Keras Deep Learning Model **Jason Brownlee** September 10, 2019 at 5:32 pm
Those methods may not k

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 **Loving the Tutorials!** Jason Brownlee September 11, 2019 at 5:30 am #

REPLY ↗

The Deep Learning with Python Ebooks

where you'll find the **Really Good** stuff.
Try data augmentation to expand the dataset:

>> SEE WHAT'S INSIDE [gmastery.com/how-to-configure-image-data-augmentation-when-training-neural-networks/](https://machinelearningmastery.com/how-to-configure-image-data-augmentation-when-training-neural-networks/)

Best practices:

<https://machinelearningmastery.com/best-practices-for-convolutional-neural-networks/>

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And try regularization methods to reduce overfitting:

<https://machinelearningmastery.com/introduction-to-regularization-to-reduce-overfitting-and-improve-generalization-error/>

Use a confusion matrix to see how the model is doing across the different classes:

<https://machinelearningmastery.com/confusion-matrix-machine-learning/>



Siddhartha Saha September 16, 2019 at 11:20 pm #

REPLY ↗

Topic: Evaluate a Model and Plot Training History**Never miss a tutorial:**

Is it mandatory that plots of accuracy on the train and test datasets must converge (e.g a plateau of the line) over training epochs?

**Picked for you:****Jason Brownlee** September 17, 2019 at 6:28 am #

REPLY ↗

Our First Deep Learning Project in

Python With Keras Step-By-Step

They are not required.

How to Grid Search Hyperparameters for
Deep Learning Models in Python With
Keras**Pervesh** October 1, 2019 at 1:23 am #we input an image of size 28*28*1; How c
ing the first kernal -> 2nd kernal ->
print pixel value at each stage.Multi-Class Classification Tutorial with the
Keras Deep Learning Library**Jason Brownlee** October 1, 2019 at 6:55 pm #You can save your Keras Deep output I
Learning Model
give an example of this here:
<https://machinelearningmastery.com/how-to-visualize-neural-networks/>**Start Machine Learning**You can master applied Machine Learning
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Loving the Tutorials?
ali October 1, 2019 at 4:27 pm #

REPLY ↗

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I have not false positive and false negative in my predictions so the accuracy should be 100%
but it is showing ~0.997 is this normal?

>> SEE WHAT'S INSIDE

**Jason Brownlee** October 2, 2019 at 7:50 pm #

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REPLY ↗

The history is an average of the performance across the batches in each epoch.

Instead, you can use `model.evaluate()` to estimate the performance of your model on a hold out dataset.**Vishnu Suresh** October 25, 2019 at 6:55 pm #

REPLY ↗

Hello Jason,

Is there a way to record the time it takes for the model to fit the data ?

Vishnu
Never miss a tutorial:



Jason Brownlee October 26, 2019 at 4:37 am #

REPLY ↗

Picked for you:

Yes, record the time before making a prediction and then again after and calculate the difference.



Your First Deep Learning Project in Python with Keras Step-By-Step



Imtiaz Ul Hassan November 1, 2019 at 8:01 am #

REPLY ↗

Deep Learning Models in Python With Keras

Jason Pretty Nice Tutorial .



I wanna ask is there a way you can get weights and Regression Tutorial with the Keras Deep Learning Library in Python



Jason Brownlee November 1, 2019 at 1:45 pm #

Multi-Class Classification Tutorial with the Keras Deep Learning Library

Thanks



Yes, you can step over the epochs manually and

Or setup some checkpoints in the Keras Deep Learning Model



Anurag Tripathi November 9, 2019 at 9:14 am #

Hi Jason,

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I am trying to get an accuracy graph but it is not what I expected and I am not able to figure it out that where am I going wrong.

The Deep Learning with Python EBook is Below is my coding, where you'll find the **Really Good** stuff.

```
# Visualize training history
from keras import Sequential
from keras.layers import Dense
import matplotlib.pyplot as plt
import numpy
# load pima indians dataset
dataset = numpy.loadtxt("pima-indians-diabetess1.csv", delimiter=",")
# split into input (X) and output (Y) variables
X = dataset[:,0:7]
Y = dataset[:,7]
# create model
model = Sequential()
model.add(Dense(50, input_dim=7, activation='relu'))
model.add(Dense(48, activation='relu'))
model.add(Dense(30, kernel_initializer='uniform', activation='relu'))
model.add(Dense(28, kernel_initializer='uniform', activation='relu'))
model.add(Dense(26, kernel_initializer='uniform', activation='relu'))
```

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```
model.add(Dense(20, kernel_initializer='uniform', activation='relu'))
Never miss a tutorial: model.add(Dense(18, kernel_initializer='uniform', activation='relu'))
model.add(Dense(16, kernel_initializer='uniform', activation='relu'))
model.add(Dense(10, kernel_initializer='uniform', activation='relu'))
model.add(Dense(8, kernel_initializer='uniform', activation='relu'))
model.add(Dense(1, activation='sigmoid'))
```

Picked for you:

Compile model
 model.compile(optimizer='adam', metrics=['acc'])
[The Python with Keras Step-By-Step](#)
 history = model.fit(X, Y, validation_split=0.25, epochs=150, batch_size=32, verbose=0)
list all data in history

 plt.plot(history.history['acc'])
 plt.plot(history.history['val_acc'])
 plt.title('model accuracy')
 plt.ylabel('accuracy')

 plt.show()

Below is the link of a snap of my accuracy graph:

[Multi-Class Classification Tutorial With the Keras Deep Learning Library](https://drive.google.com/file/d/1GUJy4frCOpgc5-Z2)

 How to Save and Load Your Keras Deep Learning Model
Jason Brownlee November 10, 2019 at 8:30 am #
 I believe since Keras 2.3. that you must

Also, your flat graph suggests the model is not learning much – looks like way too many layers!

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The Deep Learning with Python Ebook is
 **Ron S** December 2, 2019 at 4:35 am #
 where you'll find the **Really Good** stuff.

REPLY ↗

A **beginner** in student here, would love to know if i could use the "validation_split" attribute even if
 >> SEE WHAT'S INSIDE images, and not csv files – i use fit_generator instead of fit, to train.

Also thanks alot for the explanations and hits in this article!

[Start Machine Learning](#)

 **Jason Brownlee** December 2, 2019 at 6:09 am #
 Yes, you can.

REPLY ↗

 **hass** December 30, 2019 at 8:31 am #
 i test it for UNSWNB data set gives me error message
 'DataFrame' object has no attribute 'values'

REPLY ↗

Never miss a tutorial:

Jason Brownlee December 31, 2019 at 7:24 am #

REPLY ↗



December 31, 2019 at 7:24 am #

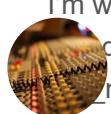


I have just posted my code and error to stackoverflow?

Picked for you:

Huda January 15, 2020 at 4:53 am #

REPLY ↗

Python with Keras Step-By-Step
Hi Jason!I'm working on a code that predicts energy consumption
and How to Grid Search Hyperparameters for
Deep Learning Models in Python With
Keras

Can you help me?



Regression Tutorial with the Keras Deep

Learning Library in Python
In __future__ import print_function

from sklearn.metrics import mean_absolute_error

import math

Multi-Class Classification Tutorial with the
Keras Deep Learning Library

import matplotlib.pyplot as plt

from pandas import read_csv

from keras.models import Sequential
How to Save and Load Your Keras Deep

Learning Model

from sklearn.preprocessing import MinMaxScaler

from sklearn.metrics import mean_squared_error

convert an array of values into a dataset matrix

def create_dataset(dataset, look_back=1):

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dataX, dataY = [], []

for i in range(len(dataset)-look_back-1):

The Deep Learning with Python EBook is

a = dataset[i:(i+look_back), 0]

where you'll find the **Really Good** stuff.

dataX.append(a)

dataY.append(dataY[-1:k, 0])

return np.array(dataX), np.array(dataY)

fix random seed for reproducibility

np.random.seed(7)

load the dataset

dataframe = read_csv('OND_Q4.csv', usecols=[7], engine='python', header=3) #wind-SPEED

dataset = dataframe.values

print(dataframe.head)

dataset = dataset.astype('float32')

normalize the dataset

scaler = MinMaxScaler(feature_range=(0, 1))

dataset = scaler.fit_transform(dataset)

split into train and test sets

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```
train_size = int(len(dataset) * 0.7) # Use 70% of data to train
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test_size = len(dataset) - train_size
train, test = dataset[0:train_size,:], dataset[train_size:len(dataset),:]
# reshape into X=t and Y=t+1
```

Picked for you:

trainX, trainY = create_dataset(train, look_back)
 X, Y, First Deep Learning Step
 Python with Keras Step-By-Step
 shape input to be [samples, time steps, features]

trainX = np.reshape(trainX, (trainX.shape[0], 1, trainX.shape[1]))
 X = np.reshape(test, (test.shape[0], 1, testX.shape[1]))

Deep Learning Models in Python With Keras
 Create and fit the LSTM network

model = Sequential()
 model.add(LSTM(4, input_shape=(1, look_back)))
 model.add(Dense(1))

Regression Tutorial with the Keras Deep Learning Library
 Multi-Class Classification Tutorial with the Keras Deep Learning Library

model.compile(loss='mean_squared_error', optimizer='adam')
 history=model.fit(trainX, trainY, epochs=5, batch_size=1)
 How to Save and Load Your Keras Deep Learning Model
 all data in history

print(history.history.keys())

train_MAPE = history.history['mape']
 valid_MAPE = history.history['val_mean_absolute_percentage_error']
 train_MSE = history.history['loss']
 Loving the Tutorials?
 valid_MSE = history.history['val_loss']

The Deep Learning with Python EBook is
 Thank you
 where you'll find the **Really Good** stuff.

[>> SEE WHAT'S INSIDE](#)



Jason Brownlee January 15, 2020 at 8:29 am #

REPLY ↗

This is a common question that I answer

<https://machinelearningmastery.com/faq/single-faq/can-you-read-review-or-debug-my-code>



Kamaleshwaran K February 7, 2020 at 5:15 pm #

REPLY ↗

Train on 582 samples, validate on 146 samples
 Epoch 1/200

KeyError Traceback (most recent call last)
 in

—> 1 model.fit(X_train, y_train, epochs=200, validation_data=(X_test, y_test), callbacks=[mcp_save], batch_size=128)

 Appling Non36\site-packages\keras\models.py in fit(self, x, y, batch_size, epochs, verbose, callbacks, validation_split, validation_data, shuffle, class_weight, sample_weight, initial_epoch, **kwargs)

Picked for you: 865 class_weight=class_weight,

866 sample_weight=sample_weight,
 Your First Deep Learning Project in Python with Keras Step-By-Step

869 def evaluate(self, x, y, batch_size=32, verbose=1,

 ~\AppData\Roaming\Python\Python36\site-packages\keras\engine\training.py in fit(self, x, y, batch_size, epochs, verbose, callbacks, validation_split, validation_steps, initial_epoch, steps_per_epoch, validation_steps, *args, **kwargs)

1596 initial_epoch=initial_epoch,

1597 steps_per_epoch=steps_per_epoch,

1598 validation_steps=validation_steps)

1599

1600 def evaluate(self, x, y,

 Multi-Class Classification Tutorial with the Keras Deep Learning Library

_labels, batch_size, epochs, verbose, callbacks, initial_epoch, steps_per_epoch, validation_steps)

170 if isinstance(ins[-1], float):

171 # How to Save and Load Your Keras Deep Learning Model

172 ins_batch = _slice_arrays(ins[:-1], batch_ids)

173 else:

174 ins_batch = _slice_arrays(ins, batch_ids)

~\AppData\Roaming\Python\Python36\site-packages\keras\engine\training.py in _slice_arrays(arrays, start, stop)

Loving the Tutorials?

404 if hasattr(start, 'shape'):

405 Start = start.tolist()

—> 406 return [None if x is None else x[start] for x in arrays]

407 else:

408 ret => SEE WHAT'S INSIDE x[start:stop] for x in arrays]

~\AppData\Roaming\Python\Python36\site-packages\keras\engine\training.py in (.0)

404 if hasattr(start, 'shape'):

405 start = start.tolist()

—> 406 return [None if x is None else x[start] for x in arrays]

407 else:

408 return [None if x is None else x[start:stop] for x in arrays]

~\Anaconda3\envs\tensorflow1\lib\site-packages\pandas\core\frame.py in __getitem__(self, key)

2999 if is_iterator(key):

3000 key = list(key)

—> 3001 indexer = self.loc._convert_to_indexer(key, axis=1, raise_missing=False)

3002

3003 # take() does not accept boolean indexers

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~\Anaconda3\envs\tensorflow1\lib\site-packages\pandas\core\indexing.py in _convert_to_indexer(self, obj, axis, is_setter, raise_missing)

1283 "# When setting missing keys are not allowed, even with .loc:
 1284 args, raise_missing=True if is_setter else raise_missing}
 -> 1285 return self._get_listlike_indexer(obj, axis, **kwargs)[1]

Picked for you:

1287 try:

 Your First Deep Learning Project in Python with Keras Step-By-Step
 ~\Anaconda3\envs\tensorflow1\lib\site-packages\pandas\core\indexing.py in _get_listlike_indexer(self, axis, raise_missing)

1090

 How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras
 92 keyarr, indexer, n, get_axis_number(axis), raise_missing, raise_missing

93)Keras

1094 return keyarr, indexer

 Regression Tutorial with the Keras Deep Learning Library in Python
 1095 indexer, n, get_axis_number(axis), raise_missing, raise_missing

1175 raise KeyError(

1176 "None of [{key}] are in the [{axis}].format(
 1177 keyarr, indexer, n, get_axis_number(axis), raise_missing, raise_missing)
 1178)Keras Deep Learning Library

1179)

 How to Save and Load Your Keras Deep Learning Model
 1176 470 874 66, 200, 308],\n dtype='int64',

Hi jason,

can u help me from get out of this eror. I searched
 hope u can help me.

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Loving the Tutorials?

The Deep Learning with Python EBook is
 Jason Brownlee February 8, 2020 at 7:06 am #
 What You'll find the **Really Good** stuff.

REPLY ↗

This is a common question that I answer here:

<http://machinelearningmastery.com/faq/single-faq/can-you-read-review-or-debug-my-code>

Start Machine Learning

 krs reddy March 5, 2020 at 11:29 pm #

history.history.keys() is now returning ['acc', 'loss', 'val_acc', 'val_loss']...

'accuracy' to shortened to 'acc'



Jason Brownlee March 6, 2020 at 5:34 am #

REPLY ↗

No, you need to update your version of Keras to 2.3.1.

Never miss a tutorial:

Huy Le March 10, 2020 at 3:15 pm #

REPLY ↗



I am a beginner to ML. When doing my project, I face a problems that I am not clear.

Picked for you:

 My problem is that the loss value shown in the last epoch after the model.fit() function finishes is different from the loss value that I get from the model.evaluate() function. However, the val_loss value between two provider show absolute agreement.

[Your First Deep Learning Project in Python with Keras Step-By-Step](#)

Please help my by taking a look at the result below:

 How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras

```
model.compile(loss='mse', optimizer=adadelta, metrics=['mse', 'mae'])
history = model.fit(x, y, nb_epoch=10, batch_size=32)
```

Epoch 10/10

 Regression Tutorial with the Keras Deep Learning Library in Python – 0s 100% [=====] – 0s 100%
loss: 0.1704 – val_mse: 0.1704 – val_mae: 0.1704

 Multi-Class Classification Tutorial with the Keras Deep Learning Library
Evaluation = model.evaluate(x, y)

0/8 [=====] – 0s 200%
Evaluation: [0.1698070764541626, 0.1698070764541626]

 How to Save and Load Your Keras Deep Learning Model
Loss value from "loss" at the last epoch is 0.228

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REPLY ↗



Jason Brownlee March 11, 2020 at 5:17 am #

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Yes, it is an estimate or an average from across the batches.

The Deep Learning with Python EBook is

I would recommend paying attention to the results from the evaluate() function where you'll find the *Really Good* stuff.

[>> SEE WHAT'S INSIDE](#)



Huy Le March 11, 2020 at 12:44 pm #

REPLY ↗

Thanks too much for your assist,

Start Machine Learning

Could you please help me on a consequent problem as:

I would like to make evaluation on the training proficiency of my model by plotting "loss value" and "val_loss value" through epoch, but evaluate() function is what we should focus on.

So could you please recommend how I should work on my evaluation.

REPLY ↗



Jason Brownlee March 11, 2020 at 1:59 pm #

The history is returned by a call to fit(), you cannot get this information from a call to evaluate().

Never miss a tutorial:

REPLY ↩

Thanks to much for your reply.

Picked for you:

As I saw examples on some forums, they plot the “loss value” and “val_loss value” (obtained from fit()) to assess the performance of the model.

 Your First Deep Learning Project in Python with Keras Step-By-Step

This is an adequate standard to evaluate the model?



How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras **Jason Brownlee** March 12, 2020 at 8:46 am #



It is a diagnostic only. Models are evaluated on the project and designing a test harness to evaluate making predictions for new data. Often repeated

[Regression Tutorial with the Keras Deep Learning Library in Python](#)



Multi-Class Classification Tutorial with the Keras Deep Learning Library **Huy Le** March 13, 2020 at 12:11 am #



Ya I see the problem.
How to Save and Load Your Keras Deep Learning Model
Thank you so much for your assist!



Jason Brownlee March 13, 2020 at 8:18 am #

REPLY ↩

Loving the Tutorials?
You're Welcome.

The Deep Learning with Python EBook is where you'll find the **Really Good** stuff.



>> SEE WHAT'S INSIDE 3, 2020 at 4:07 am #

REPLY ↩

Hi Jason,

I am running this example, but I am using cross_val_score. How can could collect history of each model evaluated?

My model history has only keys ['acc', 'loss'], but I don't know which fold or model these keys belong to??



Jason Brownlee March 13, 2020 at 8:21 am #

REPLY ↩

You could, if you ran the folds manually with a for-loop.

Never miss a tutorial:

Melissa Patricio March 13, 2020 at 11:01 pm #

REPLY ↗


 Thank you much Jason,

But is it possible to obtain the training process for all k-folds cross validation on the same plot?

Picked for you:

Your First Deep Learning Project in Python with Keras Step-By-Step



Jason Brownlee

March 14, 2020 at 8:12 am #

REPLY ↗



Yes, I have examples on the blog I believe. I think for image classification You can use the blog search.
How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras



Awesome Tip! Python Machine Keras Deep Learning Library in Python

Hi Jason,



Your blog helped me to learn machine learning easily. One other dataset I am attaching my code and model for classification. [Keras Deep Learning library](https://drive.google.com/file/d/12WRXmB1LJLjyfzvDgkVQWzqCmzHrIwA/view?usp=sharing)..Also i have added which i am getting flat line). Any suggestions from you.

Regards



How to Save and Load Your Keras Deep Learning Model

<https://drive.google.com/folderview?id=12WRXmB1LJLjyfzvDgkVQWzqCmzHrIwA>



Jason Brownlee March 18, 2020 at 6:14 am #

REPLY ↗

Thanks. I'm happy to hear that.

Loving the Tutorials?

Sorry, I don't have the capacity to review/debug your code:
The Deep Learning with Python EBook is
<https://machinelearningmastery.com/faq/single-faq/can-you-read-review-or-debug-my-code> where you'll find the **Really Good** stuff.

>> SEE WHAT'S INSIDE



ATA March 20, 2020 at 12:36 am #

REPLY ↗

thanks, my question, After training my model then later i run load_model('...') to plot some function but i get this error 'object has no attribute history' if i run print(model.history) my fit look so :

```
history=model.fit(X_train, Y_train, nb_epoch=5, batch_size=16, callbacks=[history])  
should i save the history in list if i want to use it later ?
```



Jason Brownlee March 20, 2020 at 8:45 am #

REPLY ↗

The model does not have an attribute called history, and history is not saved.

You must fit the model and the function fit() will return a dictionary called history.
Never miss a tutorial:



NightRaven April 9, 2020 at 1:19 pm #

REPLY ↗

Picked for you:

Hi Jason.



I've been following your deep learning with python book (great book by the way), and I just finished Chapter dedicated to reading history from a keras training (which this page seems to be based on)



Keras

I proceeded to write my own keras callback class to kfold'ded cross_val_score (which essentially means regression Tutorial with the Keras Deep Learning Library in Python) succeeded in that goal reasonably well, but the goal to ask you about



accuracy graph increases just like your example Keras Deep Learning Library



This is where my confusion starts. If there are entire batches saved returned by keras and before any Learning Model first instinct is that there are separate validation but validation gives lower score) .. but I tried the one executed at all, so I ruled that out.

I also ruled out an error in my code (no rounding errors, etc ...) since I confirmed that logs['accuracy'] in the on_train_batch_end callback was returning 1 for all batches on entire epochs

Loving the Tutorials?

If you need more details, or want to go over the code with me, feel free to send me an email. Right now, I The Deep Learning with Python Ebook is just want to know why the overall score isn't just 1.0 since entire epochs are trained to 1 where you'll find the **Really Good** stuff.

>> SEE WHAT'S INSIDE



Jason Brownlee April 10, 2020 at 8:19 am #

REPLY ↗

Thanks, well done on your progress!

Start Machine Learning

Yes, to use history, will need to use the Keras API directly.

Yes, accuracy cannot go higher than 1, which is 100%.

I don't follow the problem, sorry. What do you mean by "baseline score"?



NightRaven April 10, 2020 at 11:22 am #

REPLY ↗

Ok, so the general flow is this:
– estimators = []

– estimators.append(('mlp', KerasClassifier(...)))

Never miss a tutorial:
– pipeline = Pipeline(estimators)

– kfolds = StratifiedKFold(...)

– results = cross_val_score(pipeline, ..., fit_params={...myCallbackhere...})

– print("Baseline: %.2f%% (%.2f%%)" % (results.mean() * 100, results.std() * 100))

Picked for you:

This is the baseline score returned by cross_val_score function (typically returns around 80-85% with a standard deviation).

Your First Deep Learning Project in

Python Chapter 15 Step By Step

PyImageSearch 15 Step By Step learning with python, which starts off with creating a baseline before dividing into dropout regularization.



How to Grid Search Hyperparameters for Deep Learning Models in Python With

Keras Jason Brownlee April 10, 2020



Jason Brownlee



Regression Tutorial with the Keras Deep Learning Library in Python

The reason is because the model is overfitting – poor generalization performance – worst performance on the test set or on the validation set. Multi-Class Classification Tutorial with the Keras Deep Learning Library

[improve-generalization-error/](https://machinelearningmastery.com/improve-generalization-error/)

Does that help?



How to Save and Load Your Keras Deep Learning Model



NightRaven April 11, 2020

That's the thing, as far as i can tell, no testing was done at all, only training (the callback calls for on_train are firing, but on_test don't execute at all for this code)

Loving the Tutorials?

Perhaps a really simple example would better illustrate what I am seeing:

The Deep Learning with Python EBook is take the code from my previous comment, and I added the following to it: where you'll find the **Really Good** stuff.

print(results)

print(history.history['scores']) # history is the keras callback class I created.

>> SEE WHAT'S INSIDE

I also set the warning to the following:

– epochs = 2

– n_splits = 3

– batch_size=1000

This will allow us to see a simple 2x3 grid of all the raw scores returned by on_train > log['accuracy'] in the keras callback

The output is this:

– output of print(results)

— [0.55714285 0.52173913 0.60869563]

– output of print(history...)

— 0 1 2

— 0 0.411932 0.370432 0.589976

— 1 0.461256 0.380024 0.625300

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Never miss a tutorial: Each column in this pandas dataframe corresponds to one of those 3 n_splits, and there are 2 rows because there are 2 epochs



the results appear to correspond to the n_splits ...
– so intuitively, I would expect the first value in results to be the mean of the first column in the history dataframe ... but this is not so

Picked for you:



I'm wondering why I can't reproduce the score returned by cross_val_score using the

Your First Deep Learning Project should be able to right?

Python with Keras Step-By-Step



How to Grid Search Hyperparameters for

Jason Brownlee

April 11, 2020 at 11:52 am #

Deep Learning Models in Python With

Keras

The scores from history are the average of the scores from each fold in the dataset – as far as I remember.



Regression Tutorial with the Keras Deep Learning Library in Python



NightRaven April 12, 2020 at 3:18 am #

Multi-Class Classification Tutorial with the Hi Jason Keras Deep Learning Library



Your latest comment doesn't have a reply button, so I'll just reply here.



Those scores are not automatically averaged (each epoch has its own score). How to Save and Load Your Keras Deep Learning Model

is why I set batch_size to 1000, on a dataset with 1000 samples per epoch. the average of a single number is itself,

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Jason Brownlee April 12, 2020 at 6:24 am #

REPLY ↗

Fair enough. The [Deep Learning with Python](#) EBook is where you'll find the **Really Good** stuff.

>> SEE WHAT'S INSIDE



REPLY ↗

Wonderful.... I always refer your articles whenever I want to reuse the model for plot with later prediction.

I am dumping the history using pickle, as mentioned below:

```
pickle.dump(H.history, open(filename, 'wb'))
```

and want to load, something like this mentioned below:

```
Hist_later = pickle.load(filename)
```

Please help...

Start Machine Learning

Priyanka April 20, 2020 at 4:52 pm #

REPLY ↗

OK, I think I got it... worked done as....

Never miss a tutorial: when I am storing "H.history" into Hist_later



"plt.plot(np.arange(0, N), Hist_later['loss'], label='train_loss')"

Picked for you:

instead of



Your First Deep Learning Project in Python with Keras Step-By-Step



How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras

Jason Brownlee April 21, 2020 at 5:47 am #

REPLY ↩

I'm happy to hear that you solved



Regression Tutorial with the Keras Deep Learning Library in Python

Jason Brownlee April 21, 2020 at 5:46 am #



Multi-Class Classification Tutorial with the Keras Deep Learning Library

I believe you can use pickle as you suggest to



How to Save and Load Your Keras Deep Learning Model

Teixeira April 22, 2020 at 6:00 am #

Hi sir! Sorry to bother you, but your blog is the comment section is like a bonus. So I hope I am not being done too many questions because I don't want to abuse your kindness.

Loving the Tutorials?

My doubt is: How can I evaluated correctly the model and detect overfit or underfit? I read your other article about "diagnose overfitting" but back to this more simple example of training, I have some doubts.

The Deep Learning with Python EBook is

where you'll find the **Really Good** stuff. I always split my dataset on the beginning on train/test (for not bias the data with any kind of pre-proces

model evaluation I split the train set on a train and evaluate set.

On the >> SEE WHAT'S INSIDE test model I fit all the train data (without the validation split) and use

the test set from the beginning to evaluate the performance. Is this correct?

What should I do to evaluate the overall performan

test data. However, I am getting 100% accuracy or

model is overfitting. However, I always get 100% on train data, no matter the changes I do. Is this

normal?

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Jason Brownlee April 22, 2020 at 6:09 am #

REPLY ↩

Thanks.

This will help to detect over/under fit:

<https://machinelearningmastery.com/learning-curves-for-diagnosing-machine-learning-model-performance/>

Never miss a tutorial:

REPLY ↩

Hi Jason,

Picked for you:

I want to compare two models by plotting the training accuracy of both of them in one graph. How to
 [Create Your First Deep Learning Project in Python with Keras Step-By-Step](#)



How to Grid Search Hyperparameters for Deep Learning Models in Python With

REPLY ↩

Keras Perhaps store the vector of training accuracy in a file and write a program to load each file and plot as a line graph.



[Regression Tutorial with the Keras Deep Learning Library in Python](#)



merwat May 4, 2020 at 3:55 pm #

Multi-Class Classification Tutorial with the [Keras Deep Learning Library](#). Thanks for tutorials.



During training I forgot to store model history like this: `history = model.fit(trainX, trainY)`. How to Save and Load Your Keras Deep Learning Model. I need the model accuracy and loss to plot. How can I train model again?

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Jason Brownlee May 5, 2020 at 6:18 am # [Replies](#) [Edit](#) [Permalink](#)

REPLY ↩

Loving the Tutorials?
You will have to train your model again. The [Deep Learning with Python](#) EBook is

where you'll find the **Really Good** stuff.



>> SEE WHAT'S INSIDE

#

REPLY ↩

Thanks a lot for this

Start Machine Learning



Jason Brownlee May 23, 2020 at 6:21 am # [Replies](#) [Edit](#) [Permalink](#)

REPLY ↩

You're welcome!



Sagada July 24, 2020 at 2:16 am # [Replies](#) [Edit](#) [Permalink](#)

REPLY ↩

Do you know how to generate these graphs if using a pipeline? I run into the error:
AttributeError: 'Pipeline' object has no attribute 'history'

Never miss a tutorial:

July 24, 2020 at 6:33 am #

REPLY ↗

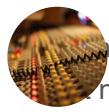
You must use the Keras api directly.

Picked for you:

Your First Deep Learning Project in Python with Keras Step-By-Step
Emmanuel July 24, 2020 at 4:52 am #

REPLY ↗

Jason,



How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras
Normal that the loss function fluctuates during training. I expect the loss values to converge. Is there a reason why



Regression Tutorial with the Keras Deep Learning Library in Python
Jason Brownlee July 24, 2020 at 6:37 am #



Multi-Class Classification Tutorial with the Keras Deep Learning Library
Yes. It should trend down.



How to Save and Load Your Keras Deep Learning Model
Emmanuel July 24, 2020 at 5:37 pm #

Hello and thanks for the fast response. It should trend down meaning the fluctuation is normal as long as it reduces? Or convergence is a condition that should be ensured?

Loving the Tutorials?

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where you'll find the **Really Good** stuff.

Jason Brownlee July 25, 2020 at 6:13 am #

REPLY ↗

>> SEE WHAT'S INSIDE

down it might be a sign that the model is converging.

Start Machine Learning

REPLY ↗



Jaka Septiadi August 14, 2020 at 10:28 pm #

Hy Jason. I wonder, how to plotting history with different epochs? For example, i trained LSTM model for 10 epochs, and again i retrained with epochs 5, is it possible that for different epochs have same line loss plot? If it possible, how can i do that? Please your sugest, thank you!



Jason Brownlee August 15, 2020 at 6:22 am #

REPLY ↗

You can create a line plot for each run, or simply save the history and create any plots you like in the future.

Perhaps I don't understand the specific problem you're having?
Never miss a tutorial:



 **Jaka Septiadi** August 14, 2020 at 10:30 pm #

REPLY ↩

Picked for you:

Because i tried to change optimizer during training, and i want that combine optimizer during training is possible to plotting Your First Deep Learning Project in Python with Keras Step-By-Step



 **Jaka Septiadi** August 14, 2020 at 10:33 pm #

REPLY ↩

How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras
 Hy jason. I wonder, how to plotting loss trained LSTM model for 10 epochs with Adam SGD with 5 epochs. So , how to plotting for 15 Regression Tutorial with the Keras Deep Loss function line plot? Please your explanation Learning Library in Python



 **Jason Brownlee** August 15, 2020 at 6:23 am #

Gather or store the plots from each



How to Save and Load Your Keras Deep Learning Model

 **Jason Brownlee** August 15, 2020 at 6:23 am #

You can plot anything you wish.

Loving the Tutorials?

 **The DataCamp Guy** September 1, 2020 at 1:36 am #
 where you'll find the **Really Good** stuff.

REPLY ↩

Nice tutorial .

>> SEE WHAT'S INSIDE

I train & 100 .

I want to get the weights of the model in the specific epoch that i have the maximum validation accuracy.
 I know that the code model.fit(verbose=1) show the

How can i do it ?



 **Jason Brownlee** September 1, 2020 at 6:37 am #

REPLY ↩

You can use early stopping or a check point.

Perhaps start here:

<https://machinelearningmastery.com/how-to-stop-training-deep-neural-networks-at-the-right-time-using-early-stopping/>

Never miss a tutorial:

Imdadhu Haque October 3, 2020 at 1:20 am #

REPLY ↗



Any can I find the validation accuracy in graph ?

Picked for you:**Jason Brownlee** October 3, 2020 at 6:09 am #

REPLY ↗

Python with Keras Step-By-Step

The above tutorials shows you how to create a line graph from training history.

**Anna** December 5, 2020 at 6:32 am #
How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras

Hello Jason,

Recently **Regression Tutorial with the Keras Deep Learning Library in Python**, it helps me my plot of accuracy (and in the one of loss) to direction. I have tried to change the number of layer_size and the number of epochs but this does not help.**Multi-Class Classification Tutorial with the Keras Deep Learning Library**

Thanks a lot!!

**How to Save and Load Your Keras Deep Learning Model****Jason Brownlee** December 5, 2020 at 8:15 pm #

Yes, loss will go down, accuracy will go up, this is normal.

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The Deep Learning with Python E-Books

REPLY ↗

where you'll find the **Really Good** stuff.

Hi Jason, You referred me this article when we talked here:

[>> SEE WHAT'S INSIDE](https://machinelearningmastery.com/difference-test-validation-datasets/#comment-594088)

I am now following the approach mentioned in this article. As you mention here

<https://machinelearningmastery.com/faq/single-faq/why-do-you-use-the-test-dataset-as-the-validation-dataset/> that in general, it is not recommended to changing the hyperparameters one by one and run have to use validation set for tuning them or detecting early stopping. So can I use validation accuracy as test accuracy since the validation set is a hold out dataset not used to train the model?

Thanks in advance!

Start Machine Learning

**Jason Brownlee** January 24, 2021 at 5:57 am #

REPLY ↗

I would not recommend that approach as you may eventually overfit your model to your dataset.

Ideally, you would hold back some data that is not touched during model selection/hyperparameter tuning for a final model evaluation.



Following data will all algorithms and tuning can cause you to find a model and config that works well only on your specific examples.

Picked for you:



Your First Deep Learning Project in **Mihir Yadav** January 24, 2021 at 8:01 am #
Python with Keras Step-By-Step

[REPLY ↗](#)

Oh, now I understood.



Thanks a lot!
How to Grid Search Hyperparameters for
Deep Learning Models in Python With
Keras



Jason Brownlee January 24, 2021 at 10:15 pm #
Regression Tutorial with the Keras Deep
Learning Library You Python welcome.



Multi-Class Classification Tutorial with the
Keras Deep Learning Library **Jason Brownlee** January 24, 2021 at 9:04 pm #



One of the best websites, I got a good guide
on how to use the Keras Deep Learning Model



Jason Brownlee February 21, 2021 at 6:11 am #

Thank you for your kind words!

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where you'll find the **Really Good** stuff.

Shweta February 24, 2021 at 4:44 pm #

[REPLY ↗](#)

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the same plot for 3 different models? Eg I want to plot accuracy v/s no of epochs graph of DenseNet, EfficientNet and ResNet on the same plot.

How can I do it?

[Start Machine Learning](#)



Jason Brownlee February 25, 2021 at 5:25 am #

[REPLY ↗](#)

Save the data to file, load each trace and add to a single plot.



Maria Argaez May 5, 2021 at 6:16 am #

[REPLY ↗](#)

I love your blog it is so helpful! Thank you so much

Never miss a tutorial:
Jason Brownlee May 6, 2021 at 5:40 am #

You're very welcome!

REPLY ↗

Picked for you:
Your First Deep Learning Project in
Danielle May 12, 2021 at 11:28 pm #

REPLY ↗

Thank for this! Found it really helpful!!


How to Grid Search Hyperparameters for
Deep Learning Models in Python With
Keras
Jason Brownlee May 13, 2021 at 6:02 am #
Regression Tutorial with the Keras Deep
Learning Library in Python

Beenish Kabir May 20, 2021 at 9:32 pm #

Keras Deep Learning Library

How to calculate the execution time of a n
execution with respect to what?
How to Save and Load Your Keras Deep
Learning Model
Jason Brownlee May 21, 2021 at 5:59 am #

You can use timeit:

<https://docs.python.org/3/library/timeit.html>
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where you'll find the **Really Good** stuff.**iaspiniehu** June 5, 2021 at 3:24 pm #

REPLY ↗

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I have issue epoch,batch size and everything.While i am training the model everytime i
am getting different accuracy,loss,val_accuracy and val_loss.but all the parameter i have used is
same. can you clear my doubt

[Start Machine Learning](#)
**Jason Brownlee** June 6, 2021 at 5:38 am #

REPLY ↗

Yes, see this:

<https://machinelearningmastery.com/faq/single-faq/why-do-i-get-different-results-each-time-i-run-the-code>
**jaspinjehu** June 5, 2021 at 3:33 pm #

REPLY ↗

Never miss a tutorial: While i am work with transfer learning it takes more time than the model taking time developed from the scratch. Why this scenario coming. Existing model is already trained right.?



Picked for you: **Jason Brownlee** June 6, 2021 at 5:44 am #

Your First Deep Learning Project In Python with Keras Step-By-Step.

That does not sound right to me.

Perhaps double-check your code.

How to Grid Search Hyperparameters for Deep Learning Models in Python With **Geethu** August 1, 2021 at 8:29 am #

Keras

Can we have more variables other than loss

metrics? And how is this loss calculated?

Regression Tutorial with the Keras Deep Learning Library in Python

Regression Tutorial with the Keras Deep

Learning Library in Python

Multi-Class Classification Tutorial with the Keras Deep Learning Library **Jason Brownlee** August 1, 2021 at 4:51 am #

Yes, you can specify as many built-in

How to Save and Load Your Keras Deep Learning Model

Jeremy August 19, 2021 at 2:54 am #

Dr. Brownlee,

Quick question for you, sir. In the tutorial, you ran .fit() on X and y prior to calling 'history' and had Python output graphs for training and validation using that data. Is there a way to do this for cross-validation (in this case, cross_val_score) so the output is either graphed per fold or an aggregate of all folds?

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, 2021 at 4:13 am #

REPLY ↩

You can see that history has the key 'val_loss' which gives you validation metrics. If you want to add more metrics, or do some tailor-made metrics, check out the [Start Machine Learning](https://www.tensorflow.org/guide/keras/train_and_evaluate/custom_metrics)

https://www.tensorflow.org/guide/keras/train_and_evaluate/custom_metrics



Jeremy August 19, 2021 at 9:36 pm #

REPLY ↩

Thanks, Adrian! If I may ask one other question: say I'm running 10-fold cross-validation and want to output a graph of accuracy and/or loss versus epochs for each individual fold. Is that possible? Where I'm stuck is figuring out where to put the plotting commands since it seems to me that I'd have to call the plotting functions inside cross_val_score and I'm not sure how to make that happen.

Never miss a tutorial:

Adrian Tam August 20, 2021 at 1:26 am #

REPLY ↗



reading your code but I can outline what you may do: You do 10-fold CV in a loop, one fold each iteration. Then you need to remember which iteration you're at, and remember the metric into a separate array. After you finish all the CV, plot these 10 arrays as 10 curves.



Your First Deep Learning Project in Python with Keras Step-By-Step



Zeynep October 1, 2021 at 3:46 pm #

REPLY ↗

How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras

Hello there, I am looking for a way to access data in a model trained in python. For example, in I access the data I trained from the inference g

faster rcnn?



Regression Tutorial with the Keras Deep Learning Library in Python



Multi-Class Classification Tutorial with the Keras Deep Learning Library

thank you, but when i try this example I go

plot(history.history['val_accuracy'])

KeyError: 'val_accuracy'



How to Save and Load Your Keras Deep Learning Model

Adrian Tam October 6, 2021 at 8:03 am #

That means you didn't do validation, or you didn't keep the accuracy score in validation.

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REPLY ↗

where you'll find the **Really Good** stuff.

Is there a line of code that is missing from the example, because I feel like I'm doing the
>> SEE WHAT'S INSIDE m getting the same error at plt.plot(history.history['val_accuracy'])

KeyError: 'val_accuracy'

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James Carmichael February 20, 2022 at 12:23 pm #

REPLY ↗

Hi ML_New_Learner...did you leave out ' from the end of 'val_accuracy'?



Zeynep October 16, 2021 at 5:13 am #

REPLY ↗

Hi Adrian. Do you know about my question? Thanks.

Never miss a tutorial!

Aman Tam October 20, 2021 at 8:33 am #

REPLY ↗

 you're going about retrieving the data you used to train your model? I don't think that's possible because the model would not remember it.

Picked for you:

Your First Deep Learning Project in Python with Keras Step-By-Step

Zeynep October 23, 2021 at 8:05 am #

REPLY ↗

Python with Keras Step-By-Step

Thank you for your return.



How to Grid Search Hyperparameters for Deep Learning Models in Python With Keras

Dash Demmehom April 6, 2022 at 9:50 pm #

X

Hi Jason,
Regression Tutorial with the Keras Deep Learning Library in Python
works for all the hard work to make these wonderful models. However, it performs much better on the testing set i.e 0.94, while it performs 0.78 (After fine-tuning hyper-parameters, shuffling data, and using SMOTE).
I have a few questions:
1) What is the best way to handle class imbalance in Keras Deep Learning Library and it is a kind of data augmentation that should not be used (Although I tested SMOTE and

To account for the imbalances I tested 1) Class_weight, 2) Sample weight tuning and 3) Sample weights. The only solution that worked for my training set was when I set up Sample weight tuning for a multi-class classification problem but I am worried about the difference between the training set and enhanced performance on the test



Could you kindly suggest a solution, please ?

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April 7, 2022 at 9:40 am #

REPLY ↗

Hi Dash... The following discussion may be of interest:

https://www.researchgate.net/post/When_can_I_use_smote_for_Deep_Learning_Models

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Leave a Reply

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Name (required)



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Email (Will not be published)



Regression Tutorial with the Keras Deep Learning Library in Python



Welcome! Multi-Class Classification Tutorial with the Keras Deep Learning Library I'm Jason Brownlee PhD and I help developers get results with

[Read more](#)



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