
Layered

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layered.activation module

class Activation

Bases: object

__call__ (*incoming*)**delta** (*incoming, outgoing, above*)

Compute the derivative of the cost with respect to the input of this activation function. Outgoing is what this function returned in the forward pass and above is the derivative of the cost with respect to the outgoing activation.

class IdentityBases: *layered.activation.Activation***__call__** (*incoming*)**delta** (*incoming, outgoing, above*)**class Sigmoid**Bases: *layered.activation.Activation***__call__** (*incoming*)**delta** (*incoming, outgoing, above*)**class Relu**Bases: *layered.activation.Activation***__call__** (*incoming*)**delta** (*incoming, outgoing, above*)**class Softmax**Bases: *layered.activation.Activation***__call__** (*incoming*)**delta** (*incoming, outgoing, above*)

layered.cost module

```
class Cost
```

```
    Bases: object
```

```
    __call__ (prediction, target)
```

```
    delta (prediction, target)
```

```
class SquaredError
```

```
    Bases: layered.cost.Cost
```

```
    Fast and simple cost function.
```

```
    __call__ (prediction, target)
```

```
    delta (prediction, target)
```

```
class CrossEntropy (epsilon=1e-11)
```

```
    Bases: layered.cost.Cost
```

```
    Logistic cost function used for classification tasks. Learns faster in the beginning than SquaredError because large errors are penalized exponentially. This makes sense in classification since only the best class will be the predicted one.
```

```
    __call__ (prediction, target)
```

```
    delta (prediction, target)
```

layered.dataset module

class Dataset

Bases: `object`

urls = []

cache = **True**

classmethod **folder** ()

parse ()

Subclass responsibility. The filenames of downloaded files will be passed as individual parameters to this function. Therefore, it must accept as many parameters as provided class-site urls. Should return a tuple of training examples and testing examples.

dump ()

load ()

download (*url*)

static **split** (*examples*, *ratio*=0.8)

Utility function that can be used within the `parse()` implementation of sub classes to split a list of example into two lists for training and testing.

class Test (*amount*=10)

Bases: `layered.dataset.Dataset`

cache = **False**

parse ()

download (*url*)

dump ()

folder ()

load ()

split (*examples*, *ratio*=0.8)

Utility function that can be used within the `parse()` implementation of sub classes to split a list of example into two lists for training and testing.

urls = []

class Regression (*amount*=10000, *inputs*=10)

Bases: `layered.dataset.Dataset`

Synthetically generated dataset for regression. The task is to predict the sum and product of all the input values. All values are normalized between zero and one.

cache = False

parse ()

download (*url*)

dump ()

folder ()

load ()

split (*examples*, *ratio*=0.8)

Utility function that can be used within the `parse()` implementation of sub classes to split a list of example into two lists for training and testing.

urls = []

class Modulo (*amount*=60000, *inputs*=32, *classes*=7)

Bases: `layered.dataset.Dataset`

Synthetically generated classification dataset. The task is to predict the modulo classes of random integers encoded as bit arrays of length 32.

cache = False

parse ()

download (*url*)

dump ()

folder ()

load ()

split (*examples*, *ratio*=0.8)

Utility function that can be used within the `parse()` implementation of sub classes to split a list of example into two lists for training and testing.

urls = []

class Mnist

Bases: `layered.dataset.Dataset`

The MNIST database of handwritten digits, available from this page, has a training set of 60,000 examples, and a test set of 10,000 examples. It is a subset of a larger set available from NIST. The digits have been size-normalized and centered in a fixed-size image. It is a good database for people who want to try learning techniques and pattern recognition methods on real-world data while spending minimal efforts on preprocessing and formatting. (from <http://yann.lecun.com/exdb/mnist/>)

urls = ['<http://yann.lecun.com/exdb/mnist/train-images-idx3-ubyte.gz>', '<http://yann.lecun.com/exdb/mnist/train-labels-idx1-ubyte.gz>']

parse (*train_x*, *train_y*, *test_x*, *test_y*)

cache = True

download (*url*)

dump ()

folder ()

load ()

static read (*data*, *labels*)

split (*examples*, *ratio=0.8*)

Utility function that can be used within the `parse()` implementation of sub classes to split a list of example into two lists for training and testing.

layered.evaluation module

compute_costs (*network, weights, cost, examples*)

compute_error (*network, weights, examples*)

layered.example module

```
class Example (data, target)
```

```
    Bases: object
```

```
    Immutable class representing one example in a dataset.
```

```
    data
```

```
    target
```

layered.gradient module

class Gradient (*network, cost*)

Bases: `object`

`__call__` (*weights, example*)

class Backprop (*network, cost*)

Bases: `layered.gradient.Gradient`

Use the backpropagation algorithm to efficiently determine the gradient of the cost function with respect to each individual weight.

`__call__` (*weights, example*)

class NumericalGradient (*network, cost, distance=1e-05*)

Bases: `layered.gradient.Gradient`

Approximate the gradient for each weight individually by sampling the error function slightly above and below the current value of the weight.

`__call__` (*weights, example*)

Modify each weight individually in both directions to calculate a numeric gradient of the weights.

class CheckedBackprop (*network, cost, distance=1e-05, tolerance=1e-08*)

Bases: `layered.gradient.Gradient`

Computes the gradient both analytically through backpropagation and numerically to validate the backpropagation implementation and derivatives of activation functions and cost functions. This is slow by its nature and it's recommended to validate derivatives on small networks.

`__call__` (*weights, example*)

class BatchBackprop (*network, cost*)

Bases: `object`

Calculate the average gradient over a batch of examples.

`__call__` (*weights, examples*)

class ParallelBackprop (*network, cost, workers=4*)

Bases: `object`

Alternative to BatchBackprop that yields the same results but utilizes multiprocessing to make use of more than one processor core.

`__call__` (*weights, examples*)

layered.network module

```
class Layer (size, activation)
    Bases: object

    apply (incoming)
        Store the incoming activation, apply the activation function and store the result as outgoing activation.

    delta (above)
        The derivative of the activation function at the current state.

class Matrices (shapes, elements=None)
    Bases: object

    __getitem__ (index)

    __setitem__ (index, data)

    copy ()

class Network (layers)
    Bases: object

    feed (weights, data)
        Evaluate the network with alternative weights on the input data and return the output activation.

    static forward (weight, activations)

    static backward (weight, activations)
```

layered.optimization module

class GradientDescent

Bases: object

Adapt the weights in the opposite direction of the gradient to reduce the error.

`__call__(weights, gradient, learning_rate=0.1)`

class Momentum

Bases: object

Slow down changes of direction in the gradient by aggregating previous values of the gradient and multiplying them in.

`__call__(gradient, rate=0.9)`

class WeightDecay

Bases: object

Slowly moves each weight closer to zero for regularization. This can help the model to find simpler solutions.

`__call__(weights, rate=0.0001)`

class WeightTying (*groups)

Bases: object

Constraint groups of slices of the gradient to have the same value by averaging them. Should be applied to the initial weights and each gradient.

`__call__(matrices)`

layered.plot module

```
class Interface (title='', xlabel='', ylabel='', style=None)
    Bases: object

    style
    title
    xlabel
    ylabel

class State
    Bases: object

class Window (refresh=0.5)
    Bases: object

    register (position, interface)

    start (work)
        Hand the main thread to the window and continue work in the provided function. A state is passed as the first argument that contains a running flag. The function is expected to exit if the flag becomes false. The flag can also be set to false to stop the window event loop and continue in the main thread after the start() call.

    stop ()
        Close the window and stops the worker thread. The main thread will resume with the next command after the start() call.

    update ()
        Redraw the figure to show changed data. This is automatically called after start() was run.

class Plot (title, xlabel, ylabel, style=None, fixed=None)
    Bases: layered.plot.Interface

    style
    title
    xlabel
    ylabel
    __call__ (values)
```

layered.problem module

```
class Problem (content=None)  
    Bases: object  
    parse (definition)
```

layered.trainer module

```
class Trainer (problem, load=None, save=None, visual=False)  
    Bases: object  
    __call__ ()  
        Train the model and visualize progress.
```

layered.utility module

repeated (*iterable*, *times*)

batched (*iterable*, *size*)

averaged (*callable_*, *batch*)

listify (*fn=None*, *wrapper=<class 'list'>*)

From <http://stackoverflow.com/a/12377059/1079110>

ensure_folder (*path*)

hstack_lines (*blocks*, *sep=' '*)

pairwise (*iterable*)

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