

Predictive maintenance Project

implemented on .Net C#

XisomDeepLearning Document

.Net API

Design deep model

XisomDeepLearning provides high-level neural network APIs to develop and evaluate deep learning models

```
using XisomNet.Layers;  
using XisomNet.Layers.Activations;
```

```
var model = new Sequential();  
model.Add(new Reshape(new long[] { 1, 28, 28 }));  
model.Add(new Conv2D(filters: 32,  
                    kernelSize: Tuple.Create(3, 3),  
                    strides: 2,  
                    padding: PaddingType.Same,  
                    useBias: true));  
model.Add(new Dense(units: 10,  
                    activation: ActiveFunctionType.ReLU,  
                    useBias: true));
```

.Net API

Preprocessing

Prepare the data for training model. It includes partitioning dataset into training data, testing data and preprocessing tasks such as: Denoising, augmentation, normalization.

Normalization

```
var MinMaxScaler = new MinMaxScaler();  
rawDatas = MinMaxScaler.FitTransform(rawDatas);  
rawTestDatas = MinMaxScaler.Transform(rawTestDatas);
```

Forming data

```
var XY = PrepDatasetTimeSeries(rawDatas, 50000);  
var TestXY = PrepDatasetTimeSeries(rawTestDatas, 50000);  
var DataSet = new DataFrameXY(XY.Item1, XY.Item2);  
var TestSet = new DataFrameXY(TestXY.Item1, TestXY.Item2);
```

Splitting data

```
var TrainVal = DataSet.SplitData(0.05);
```

.Net API

Compile model

Config the model for training

Binary classification

```
model.Compile(OptimizerType.SGD,  
             LossFunctionType.BinaryCrossEntropy,  
             MetricType.Accuracy);
```

Multi-classification

```
model.Compile(OptimizerType.Adam,  
             LossFunctionType.CategoricalCrossEntropy,  
             MetricType.Accuracy);
```

GUI Tool

Design deep model

Reshape Setting

ReshapeType: 3D

Target Shape: 1 x 28 x 28

Hints

Reshape an output to certain shape. This layer is very useful in fitting in shape of inputs between layers.

CNN2D Settings

Filters: 32

Kernel Size: 3 x 3

Strides: 2

Padding: Same

Dilation Rate: 0 x 0

Activation: Linear

Use Bias: True

Kernel_INITIALIZER: None

Bias_INITIALIZER: None

Kernel_Regularizer: None

Bias_Regularizer: None

Activity_Regularizer: None

Kernel_Constraint: None

Bias_Constraint: None

Hints

2D convolution layer. For example, spatial convolution over images. This layer creates a convolution kernel that is convolved with the layer input to produce a tensor of output. A CNN is composed of layer that filters(convolve) the inputs to get the useful information. These convolutional layer have parameter (kernel) that are learned so

Regular densely-connected Neural Network layer

GUI Tool

Preprocessing

Splitting data

Dataset

Training file: op\MultiOriginalSensors.csv **Browser**

Testing file: n\Desktop\testingSensor.csv **Browser**

Training dataset: 95 %

Testing dataset: 5 %

GUI Tool

Compile model

Loss function: MeanSquaredError

Optimizer: SGD

Metric: None

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.Net API

Training model

Use previous configuration and setting parameters to optimize model

```
model.Train(TrainVal.Item1, epochs: 100, batchSize: 16,
            TrainVal.Item2);
```

.Net API

Save/Load model

Save/load the trained model into/from hard disk for storage / performing with new data.

```
model.SaveModel(@".\XisomModel.json");
```

Save trained model

```
model.LoadModel(@".\XisomModel.json");
```

Load trained model

.Net API

Early stopping

This algorithm is used to stop training when the improvement is not increased.

```
model.Train(trainSet, epoches, batchsize);
```

Until last epoch

```
EarlyStopping es = new EarlyStopping(MonitorType, MinDelta, Patience,
MonitorMode);
MainModel.Train(trainSet, epoches, batchsize, null, es);
```

Early stopping

GUI Tool

Training model

Model

Designer file

Configuration

Learning rate



Batch size

Number of epoches

GUI Tool

Inspecting model

Utils

.Net API

.Net API

Early stopping

Early stopping

Options

Monitor

MinDelta

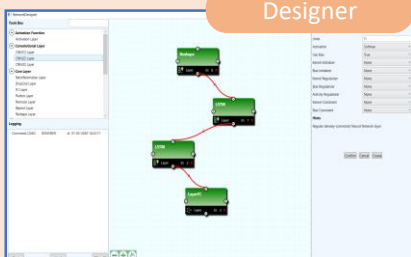
Patience

Mode

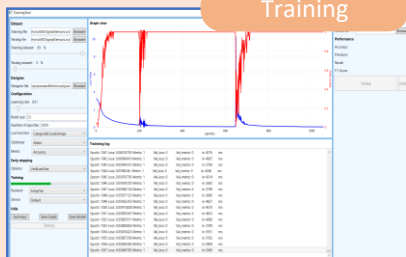
Workflows.

Methodology of developing a machine learning model.

Designer



Training



Demonstration

