ManufacturingNet: A Machine Learning Toolbox for Engineers

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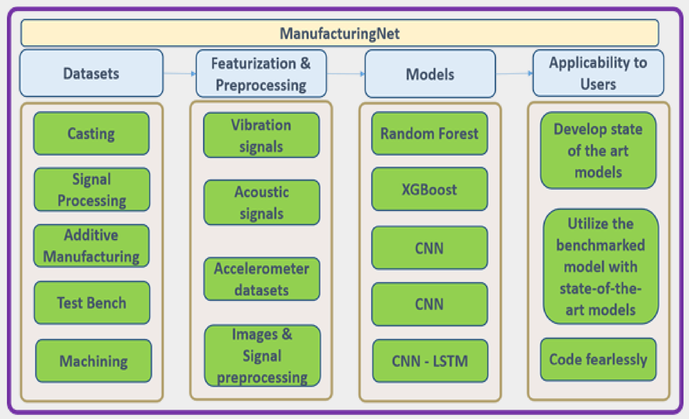
Background

The manufacturing industry generates large amounts of data, but in general, manufacturers have not been able to leverage the information available to them. Some of the roadblocks stopping professionals in the manufacturing industry from using the available data are the limited data science and programming experience. The ManufacturingNet toolbox is an attempt to alleviate these issues. Through ManufacturingNet, we offer users the ability to build complex deep learning and machine learning algorithms just by answering a few simple questions.

Overview

- Nine publicly available manufacturing datasets
- 11 deep learning and conventional machine learning models
- 20 signal featurization techniques
- Benchmarked pretrained models with state-of-the-art performance for all nine datasets
- Built-in model diagnostic tools
- Extensive documentation and tutorials



Conventional ML models

ManufacturingNet allows users to implement models like random forest, SVM, XGBoost, linear regression, and logistic regression. Moreover, if the user is unsure about model selection, we also provide the ability to run all classification models and all regression models simultaneously. Users can then decide, depending on each model's performance, which algorithm is best suited for their task.

```python
# Import necessary modules
from ManufacturingNet import datasets
from ManufacturingNet.models import AllRegressionModels
import numpy as np

# Get Mercedes-Benz dataset
datasets.MercedesData()
features = np.load('./Mercedes_files/merc_features.npy',
                   allow_pickle = True)
labels = np.load('./Mercedes_files/merc_labels.npy',
                 allow_pickle = True)

# Run all regression models
all_models = AllRegressionModels(features, labels)
all_models.run()
```

```
==========================================
= All Regression Models Parameter Inputs =
==========================================


Enable verbose logging (y/N)?  n
verbose = False

What fraction of the dataset should be used for testing (0,1)?  0.25
test_size = 0.25

==========================================
= End of inputs; press enter to continue. =
==========================================


===========
= Results =
===========

Model                R2 Score             Time (seconds)

LinearRegression     0.46154528075069656  0.14429569244384766

RandomForest         0.43743172247471984  9.198936223983765

SVR                  -0.023626227461358421 5.484614372253418

NuSVR                -0.005759599887122491 3.878767490386963

LinearSVR            0.3227457000350572   1.283017873764038

XGBRegressor         0.42116630258136745  2.4771761894226074
```

Model	Command
Linear Regression	ManufacturingNet.models.LinRegression
Logistic Regression	ManufacturingNet.models.LogRegression
SVM	ManufacturingNet.models.SVM
Random Forest	ManufacturingNet.models.RandomForest
All classification models	ManufacturingNet.models.AllClassificationModels
All classification models	ManufacturingNet.models.AllRegressionModels

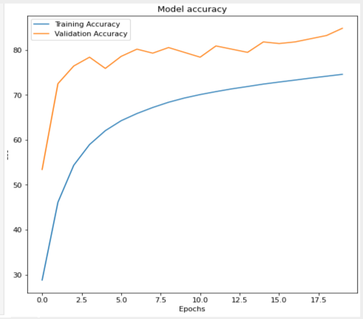
Deep Learning models

ManufacturingNet allows the user to implement deep learning models easily with very little code. The toolbox creates a deep learning model on the backend based on the user's answers, simplifying the implementation. The toolbox offers models like fully-connected neural network, convolutional neural network (CNN), long short-term memory (LSTM), CNN-LSTM and some of the standard pretrained models. After running the model for the desired number of epochs, the toolbox provides various performance metrics.

```python
from ManufacturingNet import datasets
from ManufacturingNet.models import DNN
import numpy as np

datasets.CWRUBearingData()
X = np.load('./CWRU/featurized_data.npy',
            allow_pickle = True)
Y = np.load('./CWRU/featurized_data_labels.npy',
            allow_pickle = True)

model = DNN(X, Y)
```



Model	Command
Deep Neural Network	ManufacturingNet.models.DNN
CNN2D	ManufacturingNet.models.CNN2DSignal
CNN2D Image	ManufacturingNet.models.CNN2DImage
CNN3D	ManufacturingNet.models.CNN3D
CNN LSTM	ManufacturingNet.models.CNNLSTM
LSTM	ManufacturingNet.models.LSTM
AlexNet	ManufacturingNet.models.AlexNet
VGG models	ManufacturingNet.models.VGG
ResNet models	ManufacturingNet.models.ResNet
DenseNet models	ManufacturingNet.models.DenseNet
GoogleNet	ManufacturingNet.models.GoogleNet
MobileNet	ManufacturingNet.models.MobileNet

To learn more

- The detailed documentation of ManufacturingNet is available at https://manufacturingnet.readthedocs.io
- To view ManufacturingNet's source, please visit https://github.com/BaratiLab/ManufacturingNet
- To learn more about the datasets and their benchmark results, visit http://manufacturingnet.io/