

# Machine Learning Knowledge Base

This section of the ML-INFN Confluence Space contains the Knowledge Base of fully implemented use cases. This has been created in order to provide new users getting close to Machine learning with concrete examples, with step by step guides for reproducibility.

The division into categories is multidimensional

- Dimension 1: per goal (classification, regression, clustering, technological ...)
- Dimension 2: per Machine Learning algorithms (CNN, Auto encoders, LSTM, GraphNet, ...)
- Dimension 3: per scientific field (High Energy Physics, Gravitational Waves, Medical Physics, ...)
- Dimension 4: per type of used tool

and is implemented via Confluence labels.

## Table of Use cases

Name and Link	Goal	ML Algorithms	Scientific Field	ML Tools	Comments
<a href="#">Btagging in CMS (templated version)</a>	Classification	CNN, LSTM	High Energy Physics	Keras + Tensorflow	Realistic application
<a href="#">LHCb Masterclass, with Keras</a>	Density estimation and classification	MLP	High Energy Physics	ROOT + Keras + TF	Introductory tutorial
<a href="#">MNIST in a C header</a>	Classification	MLP		Keras	Free-styling tutorial
<a href="#">LUMIN: Lumin Unifies Many Improvements for Networks</a>	Technological	CNN, RNN, GNN	High Energy Physics	PyTorch	Package use examples
<a href="#">INFERNO: Inference-Aware Neural Optimisation</a>	Classification	NN	High Energy Physics	Keras + Tensorflow	Technique application example
<a href="#">An introduction to classification with CMS data</a>	Classification	Fisher, BDT, MLP	High Energy Physics	Scikit-learn, TF2	Tutorials for Master Students
<a href="#">Virgo Autoencoder tutorial</a>	Data Compression	Autoencoder	General Relativity	Python Keras	Tutorial for student
<a href="#">Distributed training of neural networks with Apache Spark</a>	Technological	DNN	High Energy Physics	Spark + BigDL	Tutorial
<a href="#">FTS log analysis with NLP</a>	Self-supervised, clustering	NLP	High Energy Physics, Computing	Word2Vec + Rake + sklearn	Tutorial
<a href="#">Image Inpainting tutorial: how to digitally restore damaged images</a>	Inpainting	CNN U-Net	Applied Physics	Keras + Sci-kit image, PIL, OpenCV, matplotlib	Tutorial
<a href="#">Signal/background discrimination for the VBF Higgs four lepton decay channel with the CMS experiment using Machine Learning classification techniques</a>	Classification	ANNs, RF	High Energy Physics	Keras , TensorFlow, Scikit-learn	Tutorial
<a href="#">Explainability of a CNN classifier for breast density assessment</a>	Explainability AI	CNN	Medical Physics	Keras, Tensorflow	Tutorial
<a href="#">ML for smart caching</a>	Technological	ML/RL	High Energy Physics, Computing, Cache	Keras, Tensorflow, sklearn	Demo, playground
<a href="#">Signal-background Classification with Parametric Neural Networks</a>	Classification	pNN	High Energy Physics	Keras + TensorFlow 2	Tutorial
<a href="#">New Physics Learning Machine</a>	Density Estimation	NN	High Energy Physics	Keras, Tensorflow	package + tutorial
<a href="#">MLaaS4HEP for the Higgs boson ML challenge</a>	Technological	DT, MLP	High Energy Physics	XGBoost, Keras + TensorFlow 2, PyTorch	Tutorial
<a href="#">Object counting with c-ResUnet</a>	Supervised learning, Semantic Segmentation	CNN, ResUnet	Computer Vision	PyTorch, fastai	Real application, Tutorial
<a href="#">Fast classifier-based goodness of fit test for online data quality monitoring</a>	Density estimation	Logistic Regression, Kernel Methods	High Energy Physics	Pytorch, Falcon library	Tutorial + Realistic application

## How to insert a new use case

Follow the instructions provided in the [How To: Create a KB entry](#)

Once you finish with the creation of the page don't forget to edit the page "[Machine Learning Knowledge Base](#)" (this same page!) and add the use case in the "**Table of Use cases**".