# Introduction

**In Project #3 Task #3**, after displaying the dataset, you estimated the possible mapping function and model with **Non-Linear mapping functions**.

However, when the dataset ***trend is complex*** and ***the mapping function is difficult to estimate***, we can use the artificial neural network (ANN) ML algorithm, which does not require us to define the mapping function. The ANN contains an input and a hidden and output layer.

The ANN modeling is based on two computations:

1. **Feedforward feed** computes the model output (y\_hat), and the loss (yi - y\_hat).
2. **Backward propagation** will apply an **optimizer** called **gradient decent algorithms** on the loss function and compute a new weight and bias to update the old one.
3. Using the **updated parameter**, repeat a and b until the number of iterations (epoch) reaches. During this process, check whether the loss flattened out for the considered epoch.

**Example:** In Keras we use Optimizer = ‘adam’ and loss = ‘mean\_squared\_error’

* Adam = Gradient decent based optimizer, and
* loss = the error square of the difference between (predicted and the true target output value)

# Classwork-Practice:

* Use the randomly generated projectile motion-based data to evaluate how ANN recovers the physics. (*Data Generated from the Kjell Kåre Class*). The file name is **balisticwithoutwind.xlsx**

Once you practice with the projectile dataset, the next stage is to continue with your **Project #3 Task #4.** The following presents the activities. Remember, to perform any other creative experiment to provide both code- and information-wise.

# Project #3 Task #4: ANN Modeling of Task #1 Data (i.e. CleanedFeatureSelected.xlsx)

* Input Features are DEN; NEU and Vs (Check also the combination of the features)
* Output Target is Vp

Among others, here, you will investigate and present the experimental results in a bar graph of R2 value.

1. Effect of **Optimizer** (Adam, RMSprop)
2. Effect of the **Transfer function** (relu, LeakyReLU (negative\_slope = 0.1), swish)
3. The Combined Effect of **Optimizer** and **Transfer** function

**Compute your Best ANN Model-based Co and display it in a Scatter plot with Co\_True. Add also Idea-TrendLine.**

* Follow the report format and hand it in as you did for the previous projects.