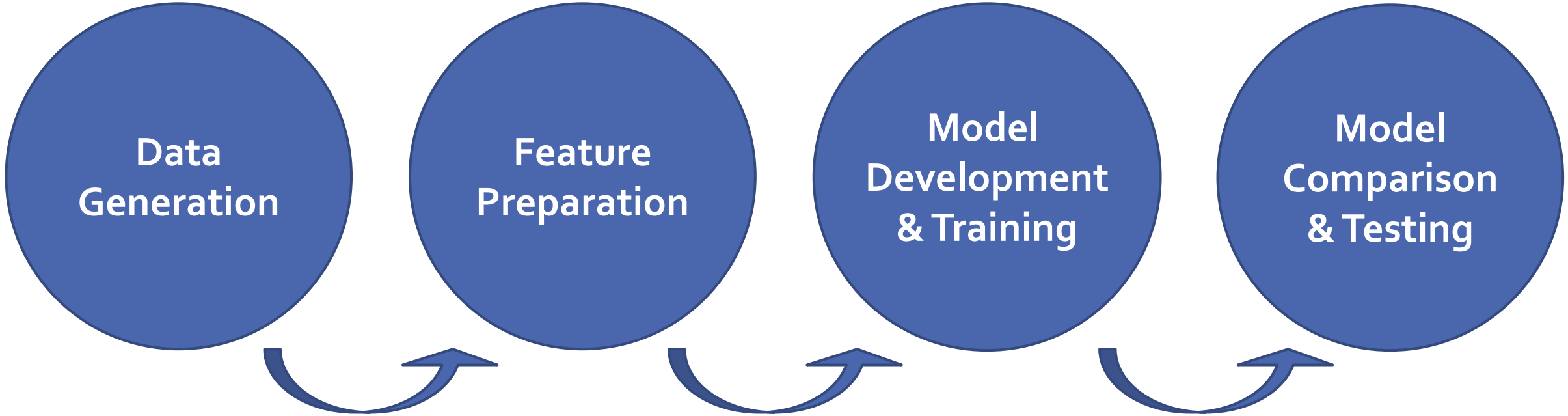
MACHINE LEARNING FOR BNE

Brazil Nut Effect Simulation and Machine Learning Pipeline

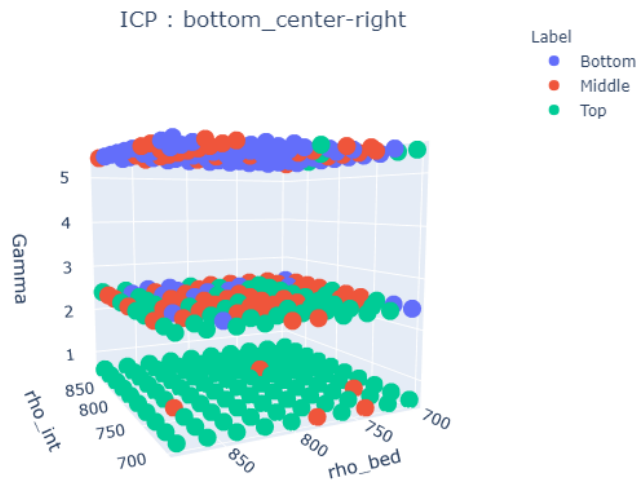
Research Pipeline

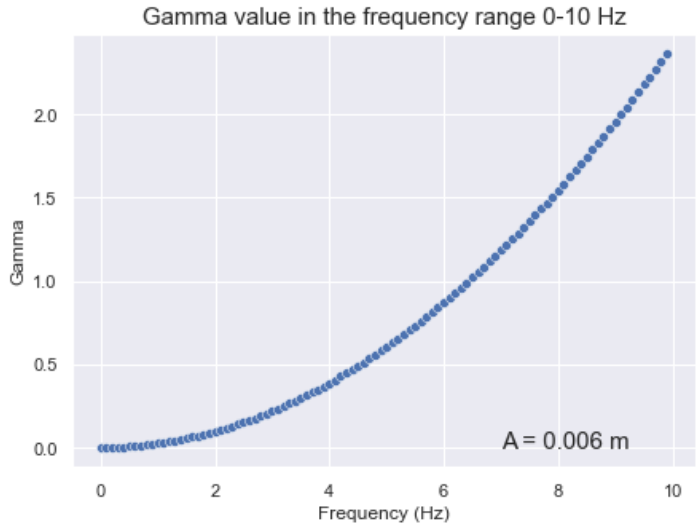


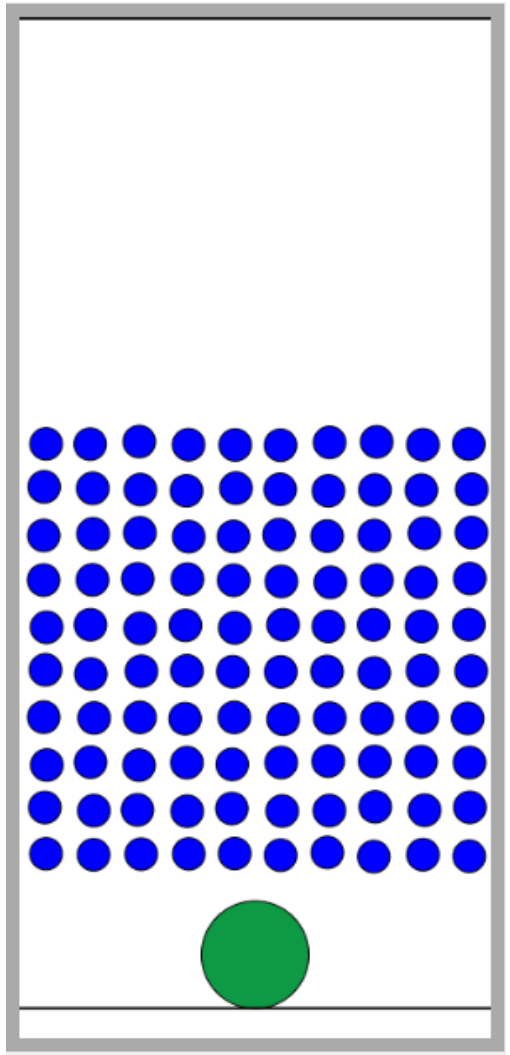
Data Generation

Randomly generated variables:

- **The initial horizontal position of the intruder,** will result in a different system configuration before the vibration begins.
- **Density of intruder and bed,** each will be generated randomly with a range 700-1400. The diameter will be fixed in a ratio of 0.02:0.006.
- **The frequency will be chosen randomly with a range of 0-10 Hz**. The amplitude is fixed so that the Gamma value will range between: 0-2.5.
- At first stage we will generate **1000 simulation.**







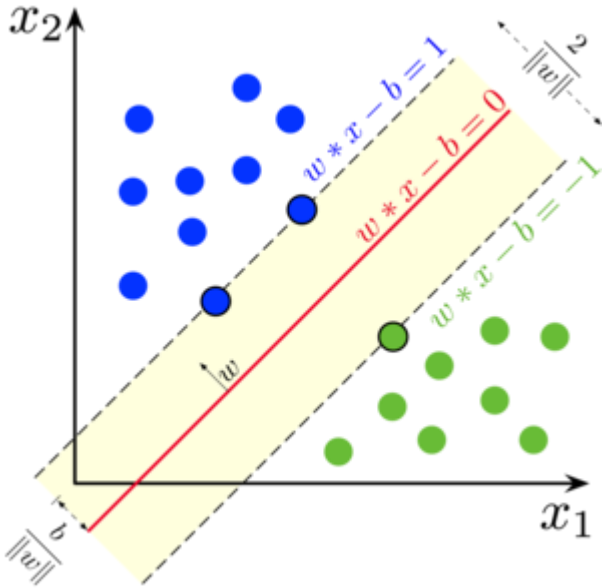
Feature Preparation

- Calculate **Gamma**
- **Scaling** and **normalization** features*:*
  - **Gamma**
  - **Contactopy**
  - **Intruder horizontal position** ($x_{intruder}/x_{container}$)
  - **Intruder** and **bed density**
- **Labeling** final vertical position of intruder:
  - $y_{intruder}$ < 25% height : **bottom**
  - 25% < $y_{intrueder}$ < 75% : **middle**
  - 75% < $y_{intruder}$: **top**

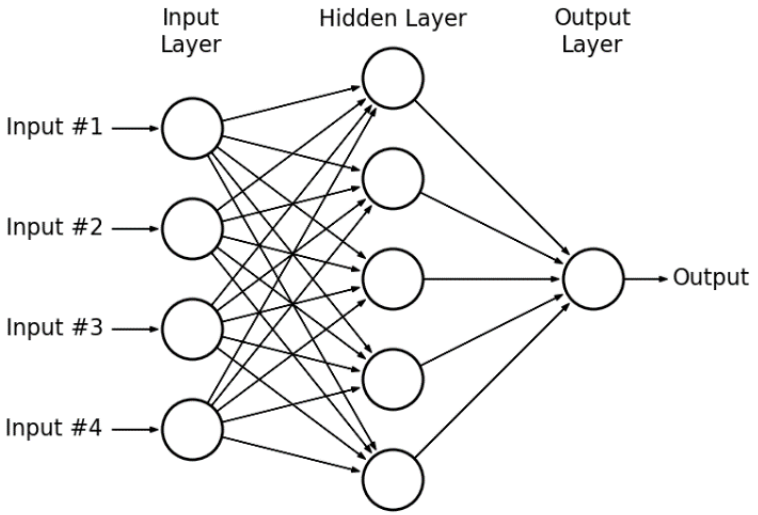
Model Development and Training

For this project, we will develop and train three kind of classification model:

- Support Vector Machine
- Artificial Neural Network (Multilayer Perceptron)
- XGBoost



SVM



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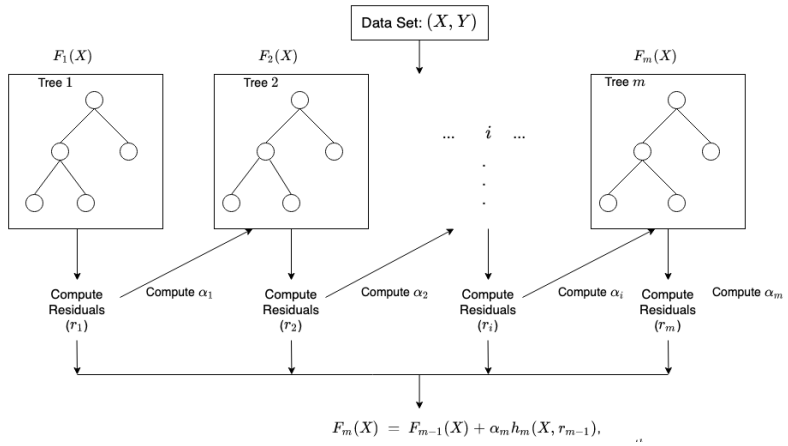

XGBoost

https://eigenvector.com/wp-content/uploads/2020/03/Wise_APACT_Nonlinear_Comparison.pdf

THANK YOU