

- We created multiclass classification models to classify CTG features into the three fetal health states :
  - Normal
  - Suspect
  - Pathological
  - labels= 1-> Normal, 2-> Suspect, 3-> Pathological.
- We chose KNN, SVM, ANN and Random Forest to solve this problem and tested them to see which one would be almost the best to deal with the issue and categorize the CTG features into 3 classes.
- The reasons for our choice these models:

KNN	SVM	ANN
<ul style="list-style-type: none"> <li>● The main advantage of KNN over other algorithms is that KNN can be used for multiclass classification. That's first thing making us think to use KNN.</li> <li>● Few hyperparameters to tune.</li> <li>● KNN mainly involves two hyperparameters, K value &amp; distance function.</li> </ul>	<ul style="list-style-type: none"> <li>● SVM take cares of outliers better than KNN.</li> <li>● SVM is more effective in high dimensional spaces.</li> <li>● SVM is relatively memory efficient.</li> <li>● SVM works relatively well when there is a clear margin of separation between classes, so we did standardization, normalization and scaling on data to achieve that and did the same with the others models also to see how this affects.</li> </ul>	<ul style="list-style-type: none"> <li>● These networks can learn from examples and apply them when a similar event arises, making them able to work through real-time events.</li> <li>● Even if a neuron is not responding or a piece of information is missing, the network can detect the fault and still produce the output.</li> <li>● They can perform multiple tasks in parallel without affecting the system performance, and this helps when have large data.</li> </ul>

➤ Results:

Models	Accuracy			
	Without standardization	With standardization	With normalization	With scaling between [1, -1]
<b>SVM</b>	0.8779	0.8779	0.9296	0.939
<b>KNN</b>	0.887	0.887	0.92	0.92
<b>ANN</b>	0.798	0.873	0.887	0.915

**Note :**

- KNN is used with n\_neighbors=5, weights='distance' >> used in prediction, in this case, closer neighbors of a query point will have a greater influence than neighbors which are further away.
- SVM with decision\_function\_shape='ovo' built in method for making it multiclass classification and kernel='poly' with degree=6.
- ANN with 3 hidden layers, they have the same number of nodes= 8, and solver='adam' for weight optimization with max\_iterations=1000 & activation function= 'relu'.
- We applied standardization by subtracting the mean from data, normalization and scaling gradually to see their influence together.