- النتائج المطلوبة من كل (code):

❖ **This study is divided into two type of models:**

Regression models	Classifcation models
Linear regression	Naïve bayes
Non-linear regression	Decision tree
Neural network	Random forest
Decision tree regression	Support vector machine (SVM)
Random forest regression	K- Nearest neigber (KNN)
Support vector regression (SVR)	
K-Nearest neigber regression (KNN)	

❖ في code non- linear regression ممكن نشتغل على polynomial (اذا بزبط .)

❖ **Objectives of the study:**

1. To make a comparative study between different machine learning methods and determine which one is most accurate in predicting the safety factor for slope stability.
2. To do sensitivity analysis to determine the effect of each input parameter.
3. To do a parametric test based on the dataset.

❖ النتائج المطلوبة:

1. اظهار actual output for training data and predict output for training data. لكل كود .

2. اظهار actual output for testing data and predict output for testing data. لكل كود .

3. ايجاد statical criteria such as RMSE, MAE, R2 , لكل من Training , testing .

مثال على ذلك :

Table 1. Total ranking of training dataset in predicting the factor of safety.

Proposed Models	Network Results					Ranking the Predicted Models					Total Ranking Score	Rank
	R^2	MAE	RMSE	RAE (%)	RRSE (%)	R^2	MAE	RMSE	RAE (%)	RRSE (%)		
Gaussian Processes	0.9467	1.5598	1.9957	31.1929	32.7404	2	2	2	2	2	10	4
Multiple Linear Regression	0.9586	1.2527	1.7366	25.0515	28.4887	4	3	4	3	4	18	2
Multi-layer Perceptron	0.9937	0.494	0.7131	9.8796	11.6985	5	5	5	5	5	25	1
Simple Linear Regression	0.9019	1.7013	2.6334	34.0224	43.2016	1	1	1	1	1	5	5
Support Vector Regression	0.9529	1.161	1.9183	23.2182	31.4703	3	4	3	4	3	17	3

Table 2. Total ranking of the testing dataset in predicting the factor of safety.

Proposed Models	Network Results					Ranking the Predicted Models					Total Ranking Score	Rank
	R^2	MAE	RMSE	RAE (%)	RRSE (%)	R^2	MAE	RMSE	RAE (%)	RRSE (%)		
Gaussian Processes	0.9509	1.5291	1.9447	30.9081	32.3841	2	2	2	2	2	10	4
Multiple Linear Regression	0.9649	1.1949	1.5891	24.1272	26.4613	3	3	4	3	4	17	3
Multi-layer Perceptron	0.9939	0.5155	0.7039	10.4047	11.8116	5	5	5	5	5	25	1
Simple Linear Regression	0.9265	1.5387	2.2618	31.0892	37.6639	1	1	1	1	1	5	5
Support Vector Regression	0.9653	1.0364	1.6362	20.9366	27.247	4	4	3	4	3	18	2

4. ايجاد معادلة من كود regression توضح الصيغة المستخدمة في ايجاد factor of safety

مثال على ذلك :

$$PS_{MLR} = (0.042 \times C_u) + (-0.0525 \times \beta) + (0.1718 \times \frac{b}{B}) + (-0.0395 \times w) + 5.9289 \quad (19)$$

$$PS_{MLP} = (-1.12353500504828 \times Y_1) - (2.38866337313669 \times Y_2) + 1.77734928298793 \quad (20)$$

5. اظهار رسمه توضح مدى دقة factor of safety بين actual و predict وذلك لكل من trainingو testing لكل كود .

مثال على ذلك :

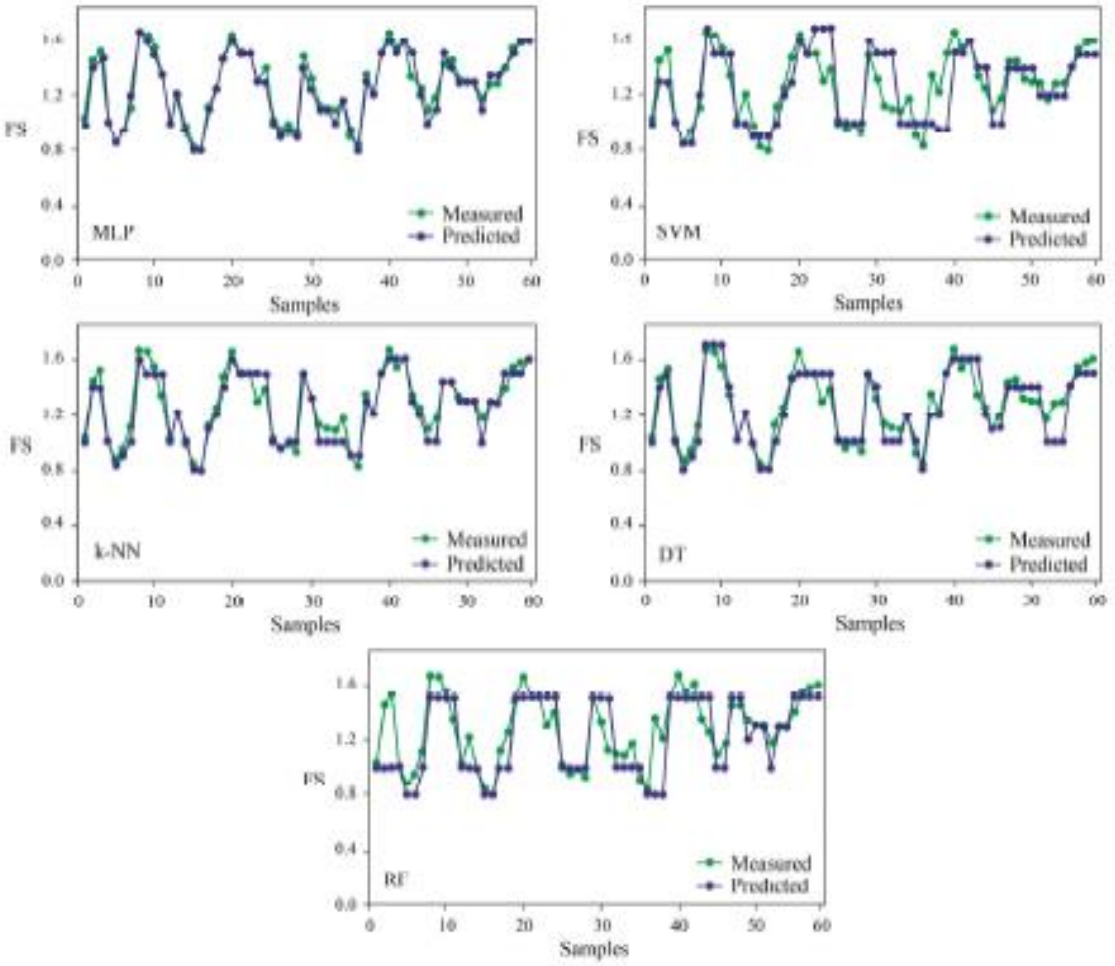

Figure 3. Results of the FS prediction in the training set by machine learning-based models.