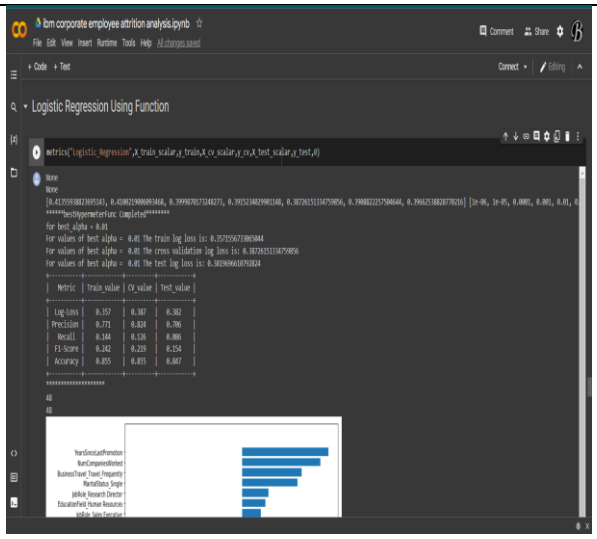
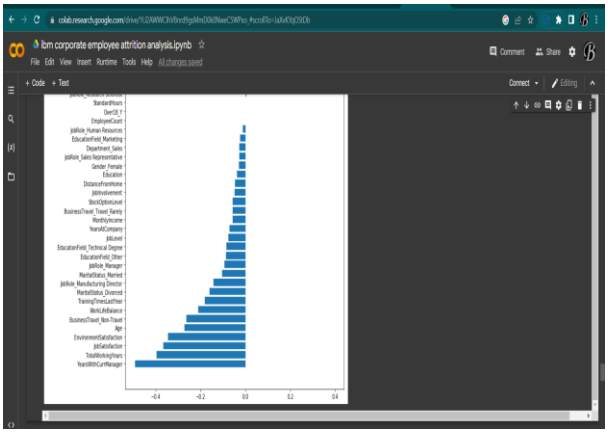
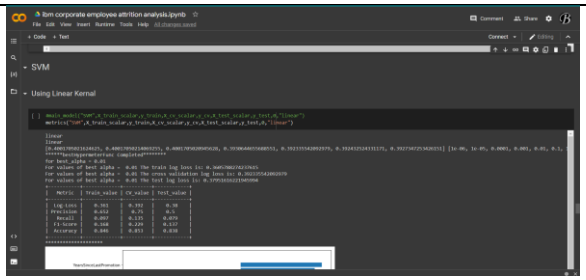
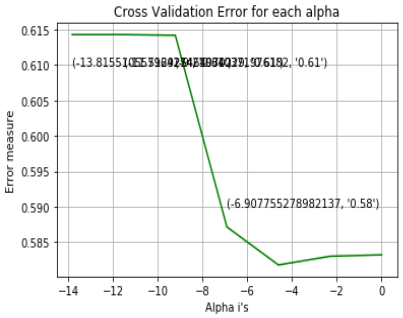
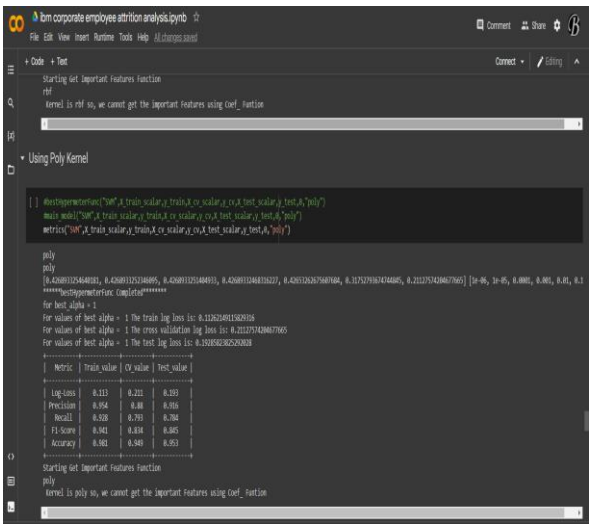
Project Development Phase
Model Performance Test

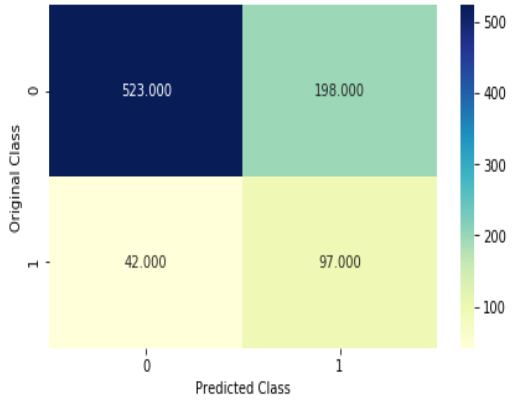
Date	10 November 2022
Team ID	PNT2022TMID37447
Project Name	Project - Corporate Employee Attrition Analytics
Maximum Marks	10 Marks

Model Performance Testing:

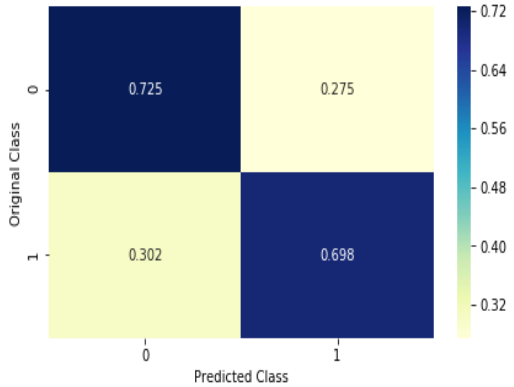
Project team shall fill the following information in model performance testing template.

S.No.	Parameter	Values	Screenshot
1.	Model Summary Regression analysis	for best_alpha = 0.01 For values of best alpha = 0.01 The train log loss is: 0.3571556733065044 For values of best alpha = 0.01 The cross validation log loss is: 0.38726151334759856 For values of best alpha = 0.01 The test log loss is: 0.3819696610792824 +----------+----------+----------+----------+ | Metric | Train_value | CV_value | Test_value | +----------+----------+----------+----------+ | Log-Loss | 0.357 | 0.387 | 0.382 | | Precision | 0.771 | 0.824 | 0.706 | | Recall | 0.144 | 0.126 | 0.086 | | F1-Score | 0.242 | 0.219 | 0.154 | | Accuracy | 0.855 | 0.855 | 0.847 |	
	SVM Model	linear linear [0.4001705021624625, 0.40017050214069255, 0.4001705020945628, 0.3930644655688551, 0.392335542092979, 0.392432524331171, 0.3927347253426151] [1e-06, 1e-05, 0.0001, 0.001, 0.01, 0.1, 1] ******bestHypermeterFunc Completed******** for best_alpha = 0.01 For values of best alpha = 0.01 The train log loss is: 0.3605788274237615 For values of best alpha = 0.01 The cross validation log loss is: 0.392335542092979 For values of best alpha = 0.01 The test log loss is: 0.37951616221945994 +----------+----------+----------+----------+ | Metric | Train_value | CV_value | Test_value | +----------+----------+----------+----------+ | Log-Loss | 0.361 | 0.392 | 0.38 | | Precision | 0.652 | 0.75 | 0.5 | | Recall | 0.097 | 0.135 | 0.079 | | F1-Score | 0.168 | 0.229 | 0.137 | | Accuracy | 0.846 | 0.853 | 0.838 | +----------+----------+----------+----------+ **********	

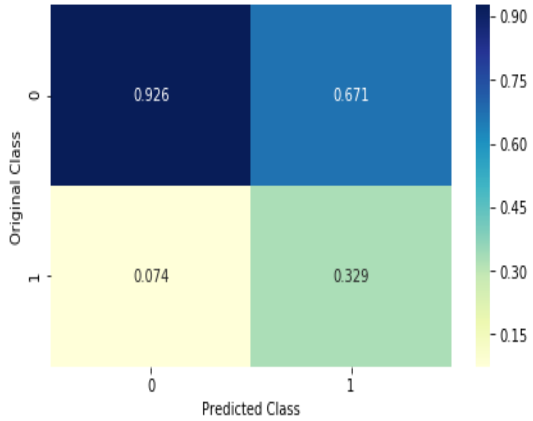
			
2.	Tune the Model Accuracy	Training Accuracy – 80% linear for alpha = 1e-06 Log Loss : 0.6143143363763562 for alpha = 1e-05 Log Loss : 0.6143143337374273 for alpha = 0.0001 Log Loss : 0.6142136356700172 for alpha = 0.001 Log Loss : 0.5871537845084024 for alpha = 0.01 Log Loss : 0.5817866567511131 for alpha = 0.1 Log Loss : 0.583009140383031 for alpha = 1 Log Loss : 0.5832164963645  linear [0.6143143363763562, 0.6143143337374273, 0.6142136356700172, 0.5871537845084024, 0.5817866567511131, 0.583009140383031, 0.5832164963645] [1e-06, 1e-05, 0.0001, 0.001, 0.01, 0.1, 1] ******bestHypermeterFunc Completed******** for best_alpha = 0.01 For values of best alpha = 0.01 The train log loss is: 0.5278361295624395 For values of best alpha = 0.01 The cross validation log loss is: 0.5817866567511131 For values of best alpha = 0.01 The test log loss is: 0.5474462705866496 ---------- Confusion Matrix ----------	 



---------- Recall ----------



---------- Precision ----------




```
+-----------+-------------+----------+------------+
|   Metric  | Train_value | CV_value | Test_value |
+-----------+-------------+----------+------------+
| Log-Loss |    0.528    |  0.582   |   0.547    |
| Precision |    0.732    |  0.289   |   0.329    |
|   Recall  |    0.774    |  0.622   |   0.698    |
| F1-Score |    0.752    |  0.394   |   0.447    |
| Accuracy |    0.745    |  0.692   |   0.721    |
+-----------+-------------+----------+------------+
Starting Get Important Features Function
linear
********************
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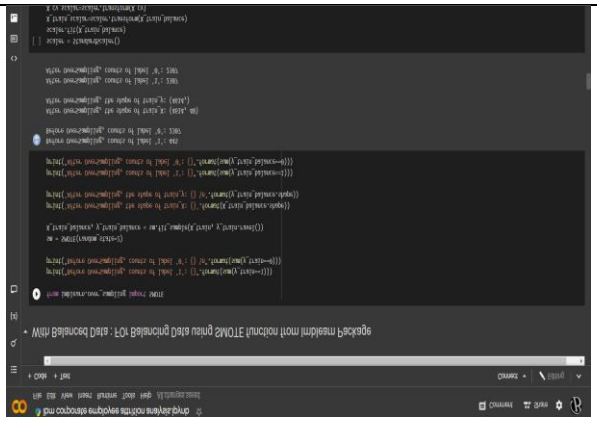
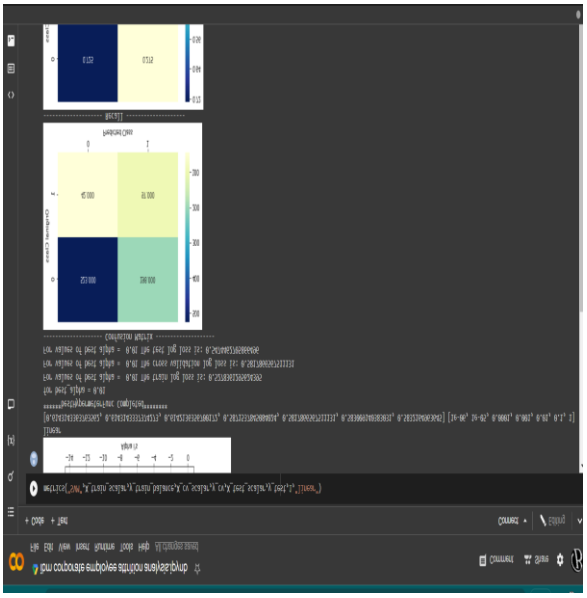
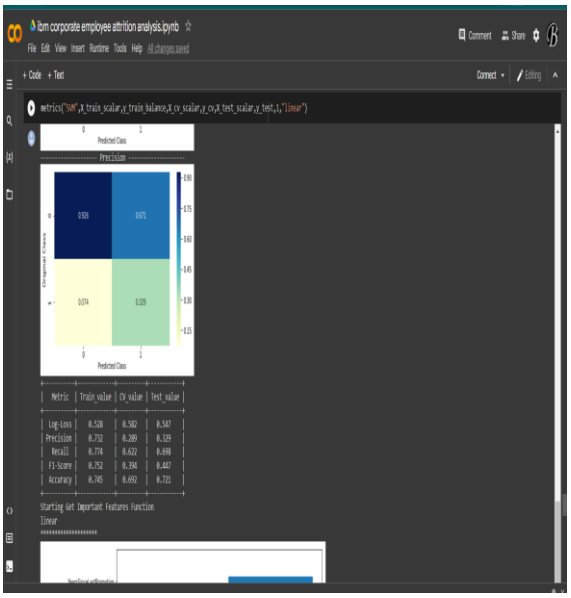
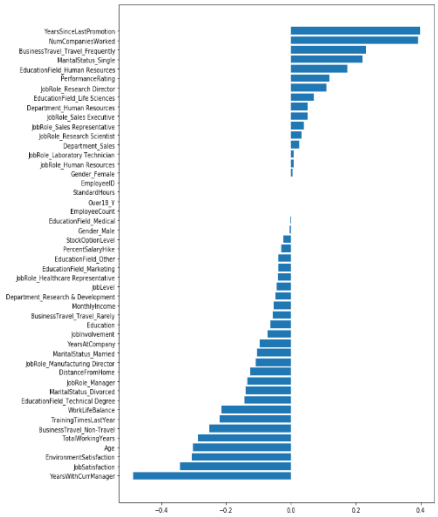
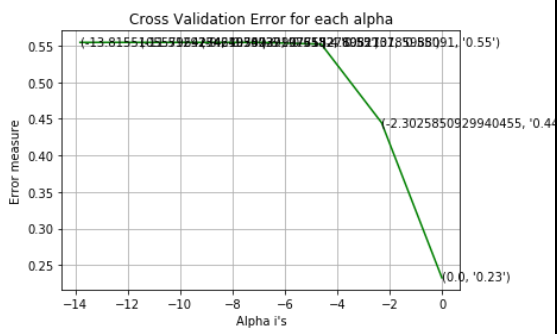
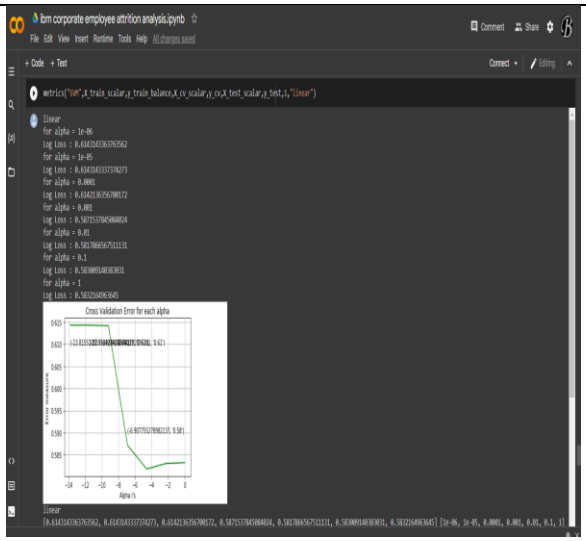
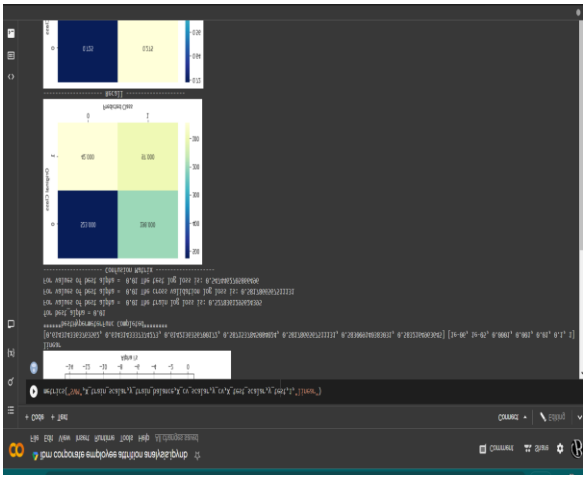
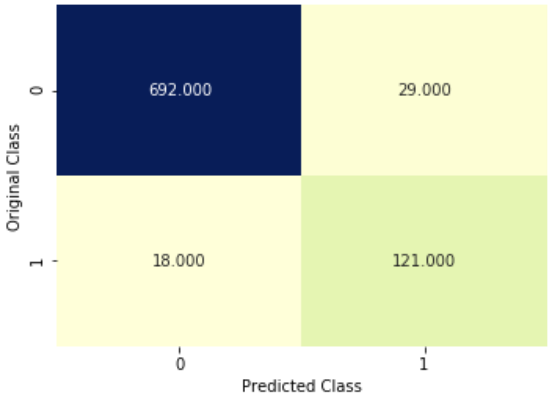


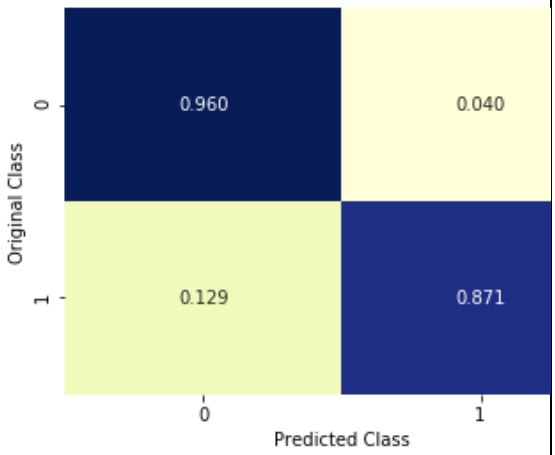




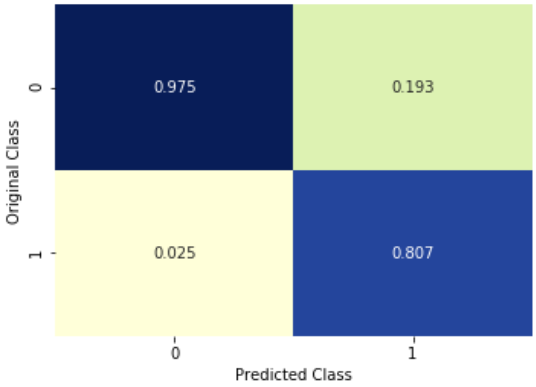
		 Validation Accuracy – 76%	
3.	Confidence Score (Only Yolo Projects)	Confidence Score – for alpha = 1e-06 Log Loss : 0.5544280465616621 for alpha = 1e-05 Log Loss : 0.5544279653425883 for alpha = 0.0001 Log Loss : 0.5544279626082605 for alpha = 0.001 Log Loss : 0.554427965596575 for alpha = 0.01 Log Loss : 0.5520345548670238 for alpha = 0.1 Log Loss : 0.4446536394141772 for alpha = 1 Log Loss : 0.23267354410235444  poly [0.5544280465616621, 0.5544279653425883, 0.5544279626082605, 0.554427965596575, 0.5520345548670238, 0.4446536394141772, 0.23267354410235444] [1e-06, 1e-05, 0.0001, 0.001, 0.01, 0.1, 1] ******bestHypermeterFunc Completed******** for best_alpha = 1 For values of best alpha = 1 The train log loss is: 0.05843126754768401 For values of best alpha = 1 The cross validation log loss is: 0.23267354410235444 For values of best alpha = 1 The test log loss is: 0.19790587725653494 ---------- Confusion Matrix ----------	 



---------- Recall ----------

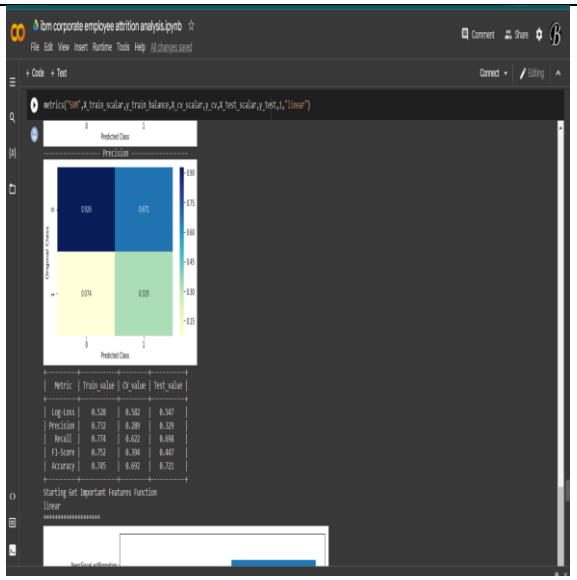


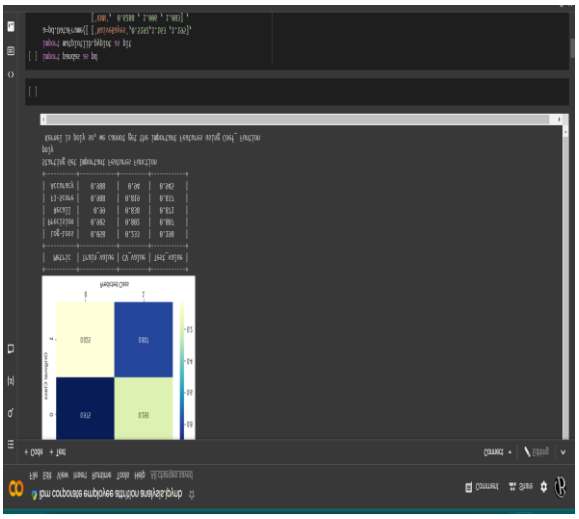
---------- Precision ----------

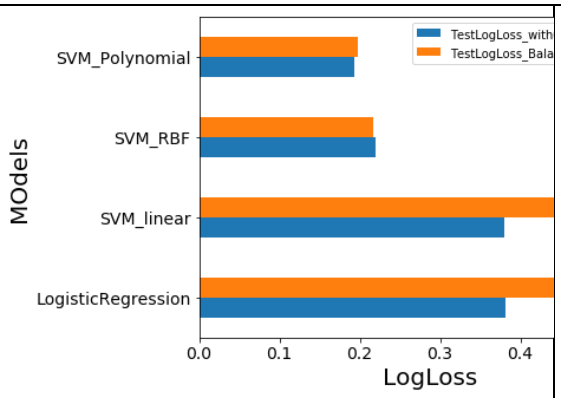
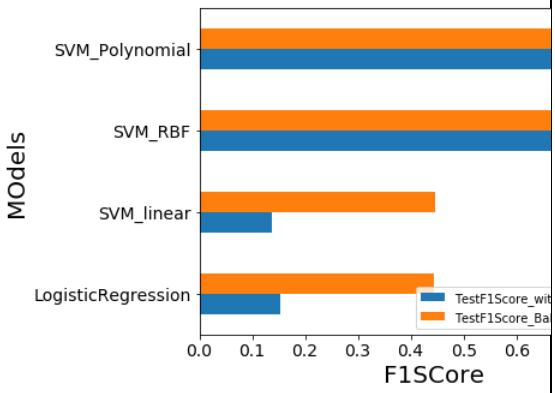
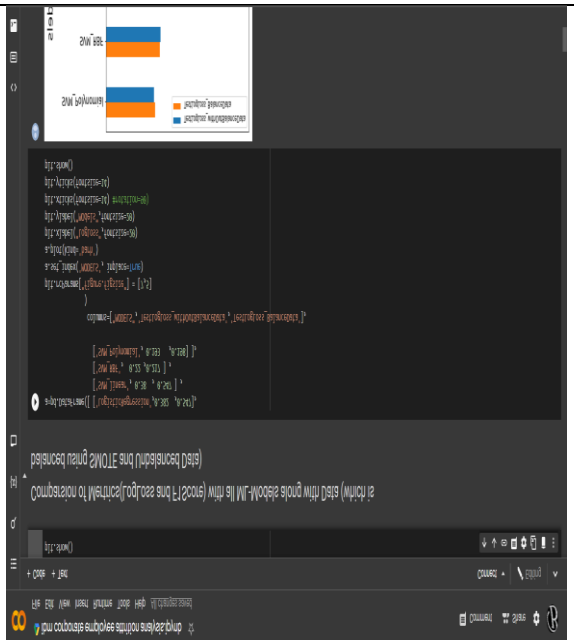
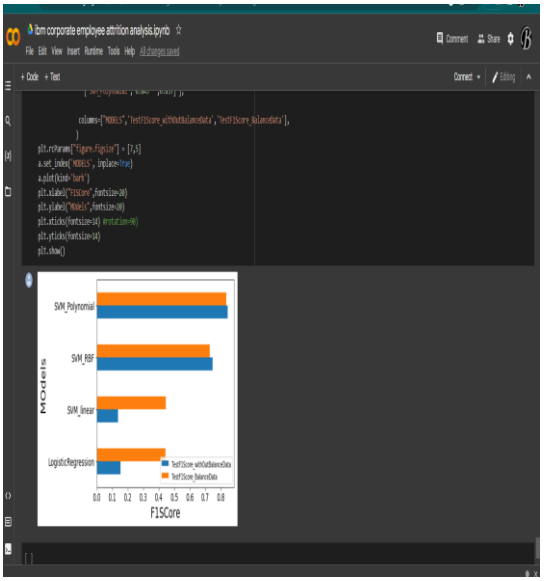


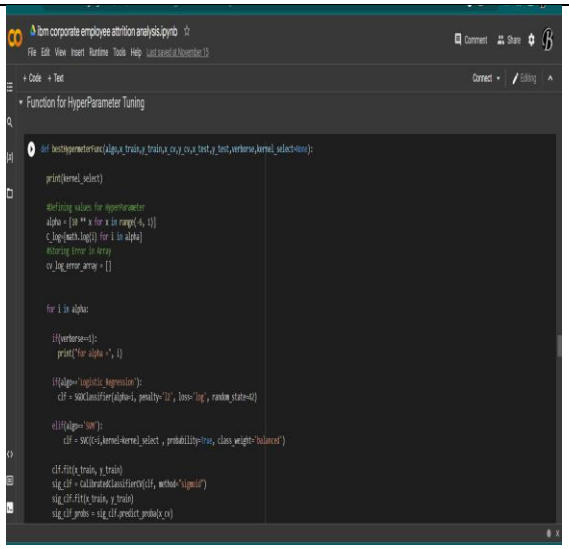
+----------+----------+----------+----------+
| Metric | Train_value | CV_value | Test_value |
+----------+----------+----------+----------+
Log-Loss	0.058	0.233	0.198
Precision	0.985	0.802	0.807
Recall	0.99	0.838	0.871
F1-Score	0.988	0.819	0.837
Accuracy	0.988	0.94	0.945
+----------+----------+----------+----------+

Starting Get Important Features Function
poly
Kernel is poly so, we cannot get the important Features using Coef_ Funtion





	Hyper Parameter Tuning - 80%	  **Regression Model:** R2 score -79% **Classification Model:** Confusion Matrix - 79% Accuracy Score- 76% Hyperparameter Tuning – 80% Validation Method – 1.predictive analysis 2.svm model 3. poly kernel 4. RBF Kernel 5.regression analysis 6.ML Model 7. SMOTE Function	 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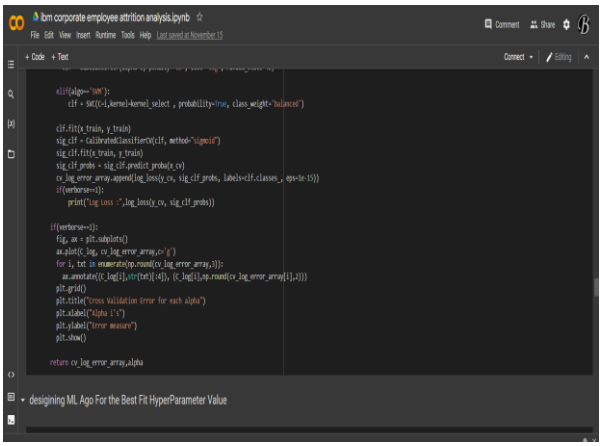
Function for HyperParameter Tuning
def bestHyperparameterFunc(algo,x_train,y_train,x_cv,y_cv,x_test,y_test,verborse,kernel_select=None):
print(kernel_select)
#defining values for HyperParameter
alpha = [10 ** x for x in range(-4, 1)]
C_log=[math.log(i) for i in alpha]
#storing Error in Array
cv_log_error_array = []
for i in alpha:
if(verborse==1):
print("for alpha =", i)
if(algo='Logistic Regression'):
clf = SGDClassifier(alpha=i, penalty='l2', loss='log', random_state=42)
elif(algo='SVM'):
clf = SVC(C=i,kernel=kernel_select , probability=True, class_weight='balanced')
clf.fit(x_train, y_train)
sig_clf = CalibratedClassifierCV(clf, method='sigmoid')
sig_clf.fit(x_train, y_train)
sig_clf_probs = sig_clf.predict_proba(x_cv)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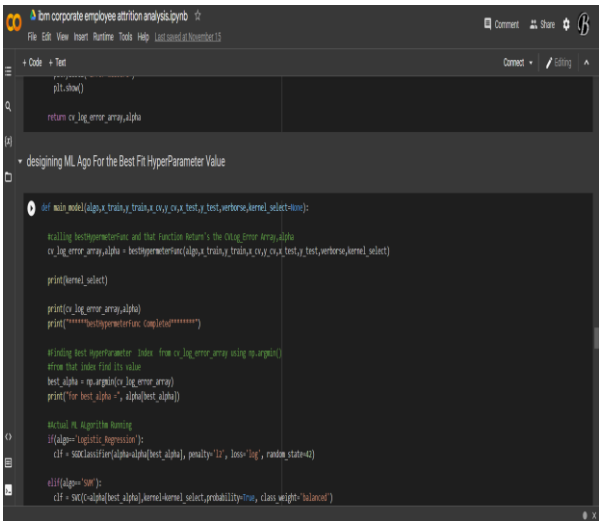
elif(algo='SVM'):
clf = SVC(C=i,kernel=kernel_select , probability=True, class_weight='balanced')
clf.fit(x_train, y_train)
sig_clf = CalibratedClassifierCV(clf, method='sigmoid')
sig_clf.fit(x_train, y_train)
sig_clf_probs = sig_clf.predict_proba(x_cv)
cv_log_error_array.append(log_loss(y_cv, sig_clf_probs, labels=clf.classes_, eps=1e-15))
if(verborse==1):
print("log loss =",log_loss(y_cv, sig_clf_probs))
if(verborse==1):
fig, ax = plt.subplots()
ax.plot(C_log, cv_log_error_array,c='g')
for i, txt in enumerate(np.round(cv_log_error_array,3)):
ax.annotate((C_log[i],str(txt)[:4]), (C_log[i],np.round(cv_log_error_array[i],2)))
plt.grid()
plt.title("Cross Validation Error for each alpha")
plt.xlabel("Alpha i's")
plt.ylabel("Error measure")
plt.show()
return cv_log_error_array,alpha
desigining ML Ago For the Best Fit HyperParameter Value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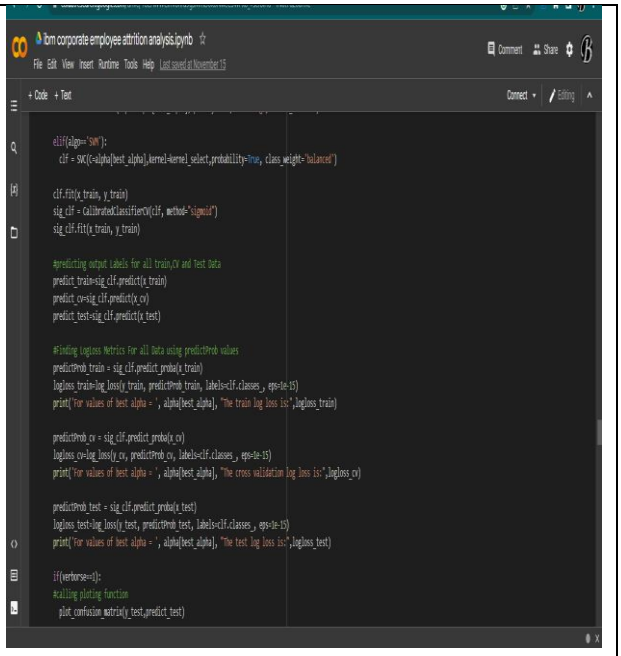
plt.show()
return cv_log_error_array,alpha
desigining ML Ago For the Best Fit HyperParameter Value
def main_model(algo,x_train,y_train,x_cv,y_cv,x_test,y_test,verborse,kernel_select=None):
#calling bestHyperparameterFunc and that Function Return's the CVLog Error Array,alpha
cv_log_error_array,alpha = bestHyperparameterFunc(algo,x_train,y_train,x_cv,y_cv,x_test,y_test,verborse,kernel_select)
print(kernel_select)
print(cv_log_error_array,alpha)
print("******bestHyperparameterFunc Complete*********")
#finding Best HyperParameter Index from cv_log_error_array using np.argmin()
#from that index find its value
best_alpha = np.argmin(cv_log_error_array)
print("for best_alpha =", alpha[best_alpha])
#Actual ML Algorithm Running
if(algo='Logistic Regression'):
clf = SGDClassifier(alpha=alpha[best_alpha], penalty='l2', loss='log', random_state=42)
elif(algo='SVM'):
clf = SVC(C=alpha[best_alpha],kernel=kernel_select,probability=True, class_weight='balanced')

			
			Iom corporate employee attrition analysis.ipynb
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			[4]
			elif(algo=='SVM'):
			clf = SVC(C=alpha[best_alpha],kernel=kernel_select,probability=True, class_weight='balanced')
			clf.fit(x_train, y_train)
			sig_clf = CalibratedClassifierCV(clf, method="sigmoid")
			sig_clf.fit(x_train, y_train)
			#predicting output Labels for all train,CV and Test Data
			predict_train=sig_clf.predict(x_train)
			predict_cv=sig_clf.predict(x_cv)
			predict_test=sig_clf.predict(x_test)
			#finding Logloss Metrics For all Data using predictProb values
			predictProb_train = sig_clf.predict_proba(x_train)
			logloss_train=log_loss(y_train, predictProb_train, labels=clf.classes_, eps=1e-15)
			print("For values of best alpha = ", alpha[best_alpha], "The train log loss is:",logloss_train)
			predictProb_cv = sig_clf.predict_proba(x_cv)
			logloss_cv=log_loss(y_cv, predictProb_cv, labels=clf.classes_, eps=1e-15)
			print("For values of best alpha = ", alpha[best_alpha], "The cross validation log loss is:",logloss_cv)
			predictProb_test = sig_clf.predict_proba(x_test)
			logloss_test=log_loss(y_test, predictProb_test, labels=clf.classes_, eps=1e-15)
			print("For values of best alpha = ", alpha[best_alpha], "The test log loss is:",logloss_test)
			if(verbose==1):
			#calling plotting function
			plot_confusion_matrix(y_test,predict_test)