CHAPTER 7

PERFORMANCE ANALYSIS

7.1 Testing

In machine learning, we often use the classification models to get a predicted result of population data. Classification which is one of the two sections of supervised learning, deals with data from different categories. The training dataset trains the model to predict the unknown labels of population data. There are multiple algorithms, namely, Logistic regression, K-nearest neighbour, Decision tree, Naive Bayes and Neural networks etc. All these algorithms have their own style of execution and different techniques of prediction. But, at the end, we need to find the effectiveness of an algorithm. To find the most suitable algorithm for a particular business problem, there are few model evaluation techniques. In this final phase, we will test our classification model on our prepared image dataset and also measure the performance on our dataset. To evaluate the performance of our created classification and make it comparable to current approaches, we use accuracy to measure the effectiveness of classifiers. After model building, knowing the power of model prediction on a new instance, is very important issue. Once a predictive model is developed using the historical data, one would be curious as to how the model will perform on the data that it has not seen during the model building process. One might even try multiple model types for the same prediction problem, and then, would like to know which model is the one to use for the real-world decision making situation, simply by comparing them on their prediction performance (e.g., accuracy). To measure the performance of a predictor, there are commonly used performance metrics, such as accuracy, recall etc. First, the most commonly used performance metrics will be described, and then some famous estimation methodologies are explained and compared to each other. "Performance Metrics for Predictive Modelling In classification problems, the primary source of performance measurements is a coincidence matrix (classification matrix or a contingency table)". Above figure shows a coincidence matrix for a two-class classification problem.

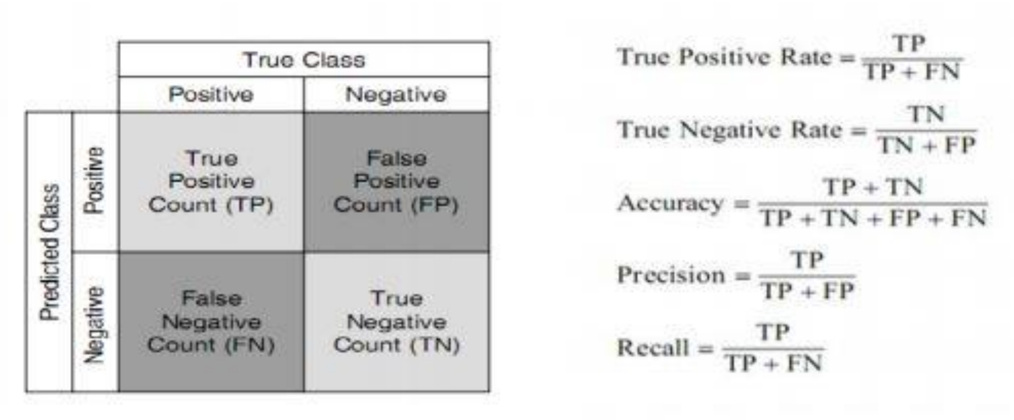

Figure 7.1: Confusion Matrix and Formulae

As being seen in above figure, the numbers along the diagonal from upper-left to lower-right represent the correct decisions made, and the numbers outside this diagonal represent the errors. "The true positive rate (also called hit rate or recall) of a classifier is estimated by dividing the correctly classified positives (the true positive count) by the total positive count. The false positive rate (also called a false alarm rate) of the classifier is estimated by dividing the incorrectly classified negatives (the false negative count) by the total negatives. The overall accuracy of a classifier is estimated by dividing the total correctly classified positives and negatives by the total number of samples.

7.2 Results

ASM_0	Contrast_0	Corrleation_0	entropy_0	ASM_45	Contrast_45	Corrleation_45	entropy_45	ASM_90	Contrast_90	Corrleation_90	entropy_90	ASM_135	Contrast_135	Corrleation_135	entropy_135
0.00172395	33.1065	0.00260701	9.58799	0.00139663	51.2526	0.00252407	9.81868	0.00193819	18.9931	0.00268273	9.3873	0.00146805	45.7322	0.00257421	9.763
0.00340025	11.9869	0.0103142	8.61022	0.00245015	25.0293	0.00957997	9.03137	0.00291712	17.718	0.0101694	8.81708	0.00241587	25.5244	0.00963176	9.05451
0.0015227	24.751	0.00210108	9.70732	0.00127587	53.5459	0.00207255	9.93634	0.00161666	23.791	0.00212767	9.62038	0.00133309	31.2345	0.00214354	9.86117
0.00491029	85.4118	0.00235731	8.79906	0.00441584	139.809	0.00227347	8.93159	0.00505523	87.5637	0.00236598	8.82046	0.00388166	158.919	0.00213772	9.07409
0.0108451	107.259	0.00164879	8.05676	0.00917116	178.251	0.00156553	8.23305	0.0106835	149.327	0.00162321	8.08391	0.00869848	274.532	0.00141162	8.33924
0.002405	115.087	0.000829987	9.65707	0.00190314	168.733	0.000815062	9.82245	0.00214977	151.476	0.000814166	9.7704	0.0017397	302.311	0.00076046	9.96658
0.00324798	69.8551	0.000854503	9.04243	0.00267792	129.629	0.000834589	9.28295	0.00300142	96.4547	0.000845913	9.16982	0.0024353	167.693	0.000819521	9.38197
0.00220741	81.7567	0.00108197	9.56839	0.00179613	134.444	0.00106497	9.75628	0.00208846	102.269	0.00107409	9.61525	0.00166857	191.412	0.00102235	9.83958
0.021708	63.0053	0.00210919	6.81333	0.0174016	176.037	0.00195988	7.136	0.0201999	112.678	0.00218347	6.94155	0.0173597	144.743	0.00211596	7.12296
0.0104773	21.1829	0.00492736	7.68876	0.00803702	55.8567	0.00439093	7.99929	0.00914952	39.5159	0.00474917	7.81157	0.00783496	56.0541	0.00445192	8.02651
0.00247264	14.0229	0.00335736	9.08244	0.00212874	21.8682	0.00343528	9.27235	0.00267988	12.0106	0.00349266	8.9851	0.00208593	22.0112	0.00345968	9.30459
0.00141741	35.4404	0.00125635	9.83386	0.00110053	64.1412	0.00128665	10.1301	0.00124948	42.7253	0.00130361	9.97626	0.00108781	65.8755	0.00128497	10.1488
0.00711703	24.4257	0.00129131	8.51007	0.00523292	170.249	0.00117711	8.92412	0.0064693	158.57	0.00118606	8.77671	0.00554659	176.37	0.00117225	8.8599
0.00224773	18.0261	0.00233202	9.18078	0.00173973	36.2249	0.0023726	9.51883	0.00210346	27.8927	0.00239856	9.26115	0.00179174	41.7239	0.00236003	9.48497
0.00149838	36.9441	0.00439369	9.7349	0.00138072	45.3597	0.00432704	9.82472	0.00125514	61.5906	0.00409957	9.96365	0.00103265	126.77	0.00336251	10.1812
0.00452245	101.043	0.000662105	8.66254	0.00398272	135.154	0.000651719	8.83343	0.00499725	36.5143	0.000673351	8.48942	0.00397637	129.171	0.000652968	8.82985
0.00325598	11.4486	0.00368047	8.96653	0.00225275	41.1569	0.00357208	9.45731	0.00267422	29.269	0.0036717	9.28362	0.00237285	34.6893	0.00362785	9.36886
0.00584756	6.18939	0.00558297	8.12626	0.00469422	15.0855	0.00577639	8.43562	0.00526814	10.7061	0.00563448	8.27716	0.00423623	16.374	0.00567125	8.54941
0.0067212	6.83592	0.0118802	7.82297	0.00580343	10.1901	0.0117998	8.01003	0.0076828	4.99347	0.0122976	7.64274	0.00561494	10.0104	0.0118225	8.04953
0.0322815	30.2151	0.00453927	6.71725	0.0291147	62.8312	0.00405851	6.99008	0.031093	50.3882	0.00426672	6.91092	0.0278117	83.7551	0.00384842	7.04245
0.00720666	80.6539	0.00202049	8.51554	0.00513313	191.132	0.00177007	8.9404	0.00615277	124.009	0.00192076	8.78022	0.00568537	172.753	0.00181035	8.85208

Figure 7.2: Sample Dataset

A total of 2000 image samples are used for training and testing the SVM model as data sets. The training and test dataset are divided into 80% and 20% of the total image dataset respectively.

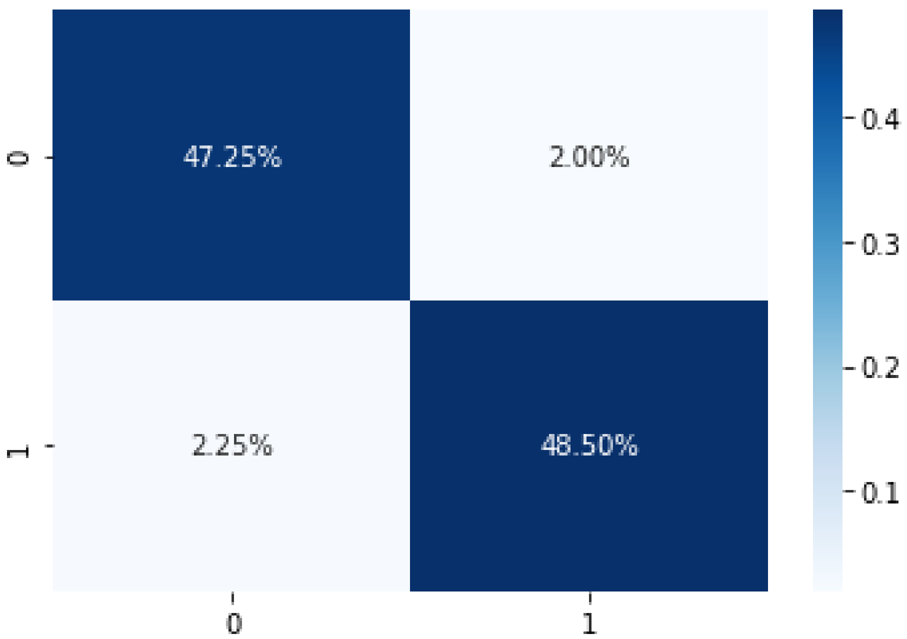

Figure 7.3: Confusion Matrix

After the model evaluation process the model showed a promising accuracy of 95.75% therefore the trained model was saved as a pickle file and a separate module was implemented to check the classification result of the model wherein the user has to input a query image of a pipe and the classification label was obtained for the query image.