

1 STATEMENT TYPES AND THEIR CLASS NAMES

Label	Class name
If	com.github.javaparser.ast.stmt.IfStmt
For	com.github.javaparser.ast.stmt.ForStmt
While	com.github.javaparser.ast.stmt.WhileStmt
Return	com.github.javaparser.ast.stmt.ReturnStmt
Ternary	com.github.javaparser.ast.expr.ConditionalExpr
Method	com.github.javaparser.ast.expr.MethodCallExpr
Assert	com.github.javaparser.ast.stmt.AssertStmt
Do	com.github.javaparser.ast.stmt.DoStmt
VarDecl	com.github.javaparser.ast.body.VariableDeclarator
Assign	com.github.javaparser.ast.expr.AssignExpr
Expression	com.github.javaparser.ast.stmt.ExpressionStmt
ObjCreation	com.github.javaparser.ast.expr.ObjectCreationExpr
ArrInit	com.github.javaparser.ast.expr.ArrayInitializerExpr
Cast	com.github.javaparser.ast.expr.CastExpr

Statement types defined in our research and their respective class names in JavaParser.

2 EXPLORATION OF DIFFERENT ARCHITECTURES

Model	Feature Extraction	Fine Tuning	Randomly Initialized
Accuracy	0.732	0.788	0.790
F1	0.709	0.781	0.777
Precision	0.776	0.809	0.831
Recall	0.653	0.756	0.730

Table 1: Evaluation comparison of different architectures.

3 QUANTITATIVE EVALUATION, PER TYPE AND COMPARATOR

Context Type	TP	TN	FP	FN	Total Buggy	Total Bugfree	Acc	Recall	Precision	F1
FORlessEquals	15906	177	573	2016	17922	750	0.8613	0.8875	0.9652	0.9247
FORless	214	16505	1417	536	750	17922	0.8954	0.2853	0.1312	0.1798
IFgreaterEquals	7835	3831	2253	3025	10860	6084	0.6885	0.7215	0.7767	0.7480
IFgreater	3530	9290	1570	2554	6084	10860	0.7566	0.5802	0.6922	0.6313
IFlessEquals	4498	900	735	1632	6130	1635	0.6952	0.7338	0.8595	0.7917
IFless	605	5087	1043	1030	1635	6130	0.7330	0.3700	0.3671	0.3686
WHILEgreaterEquals	813	237	150	251	1064	387	0.7236	0.7641	0.8442	0.8022
WHILEgreater	185	881	183	202	387	1064	0.7347	0.4780	0.5027	0.4901
WHILElessEquals	877	57	87	387	1264	144	0.6634	0.6938	0.9098	0.7873
WHILEless	33	1070	194	111	144	1264	0.7834	0.2292	0.1454	0.1779
RETURNgreaterEquals	553	284	104	245	798	388	0.7057	0.6930	0.8417	0.7601
RETURNgreater	266	685	113	122	388	798	0.8019	0.6856	0.7018	0.6936
TERNARYgreaterEquals	421	83	88	355	776	171	0.5322	0.5425	0.8271	0.6553
TERNARYgreater	77	627	149	94	171	776	0.7434	0.4503	0.3407	0.3879
FORgreater	488	129	122	98	251	586	0.7372	0.8328	0.8000	0.8161
FORgreaterEquals	107	515	71	144	586	251	0.7431	0.4263	0.6011	0.4988
METHODgreaterEquals	375	57	63	181	556	120	0.6391	0.6745	0.8562	0.7545
METHODgreater	42	441	115	78	120	556	0.7145	0.3500	0.2675	0.3032
TERNARYlessEquals	304	49	56	201	505	105	0.5787	0.6020	0.8444	0.7029
TERNARYless	48	437	68	57	105	505	0.7951	0.4571	0.4138	0.4344
RETURNlessEquals	302	120	79	92	394	199	0.7116	0.7665	0.7927	0.7794
RETURNless	111	338	56	88	199	394	0.7572	0.5578	0.6647	0.6066
METHODlessEquals	111	83	50	57	168	133	0.6445	0.6607	0.6894	0.6748
METHODless	42	129	39	91	133	168	0.5681	0.3158	0.5185	0.3925
ASSERTgreaterEquals	56	66	16	48	104	82	0.6559	0.5385	0.7778	0.6364
ASSERTgreater	36	70	34	46	82	104	0.5699	0.4390	0.5143	0.4737
VARDECLgreaterEquals	104	26	7	47	151	33	0.7065	0.6887	0.9369	0.7939
VARDECLgreater	7	124	27	26	33	151	0.7120	0.2121	0.2059	0.2090
DOgreaterEquals	86	13	10	44	130	23	0.6471	0.6615	0.8958	0.7611
DOgreater	8	111	19	15	23	130	0.7778	0.3478	0.2963	0.3200
DOlessEquals	78	2	4	62	140	6	0.5479	0.5571	0.9512	0.7027
DOless	4	110	30	2	6	140	0.7808	0.6667	0.1176	0.2000
ASSIGNgreaterEquals	51	18	12	59	110	30	0.4929	0.4636	0.8095	0.5896
ASSIGNgreater	11	87	23	19	30	110	0.7000	0.3667	0.3235	0.3438
ASSERTlessEquals	56	23	23	16	72	46	0.6695	0.7778	0.7089	0.7417
ASSERTless	13	57	15	33	46	72	0.5932	0.2826	0.4643	0.3514
VARDECLlessEquals	25	20	11	32	57	31	0.5114	0.4386	0.6944	0.5376
VARDECLless	11	42	15	20	31	57	0.6023	0.3548	0.4231	0.3860
ASSIGNlessEquals	9	4	2	13	22	6	0.4643	0.4091	0.8182	0.5455
ASSIGNless	0	17	5	6	6	22	0.6071	0.0000	0.0000	0.0000
EXPRESSIONgreaterEquals	10	2	1	13	23	3	0.4615	0.4348	0.9091	0.5882
EXPRESSIONgreater	0	22	1	3	3	23	0.8462	0.0000	0.0000	0.0000
EXPRESSIONlessEquals	5	1	2	2	7	3	0.6000	0.7143	0.7143	0.7143
EXPRESSIONless	0	4	3	3	3	7	0.4000	0.0000	0.0000	0.0000
OBJCREATIONgreaterEquals	3	1	0	4	7	1	0.5000	0.4286	1.0000	0.6000
OBJCREATIONgreater	0	5	2	1	1	7	0.6250	0.0000	0.0000	0.0000
OBJCREATIONlessEquals	1	0	0	1	2	0	0.5000	0.5000	1.0000	0.6667
OBJCREATIONless	0	1	1	0	0	2	0.5000	0.0000	0.0000	0.0000
Total	38317	42838	9641	14162	104958	104958	0.7732	0.7301	0.7990	0.7630

Quantitative evaluation results for all context types analyzed

4 PERFORMANCE OF AN EXCLUSIVE MODEL FOR “IF” STATEMENTS

	TP	TN	FP	FN	Total	Accuracy	Recall	Precision	F1
IFgreaterEquals	7,978	3647	2,460	2,845	16,930	0.6867	0.7371	0.7643	0.7505
IFgreater	1,744	8,428	2,395	4,363	16,930	0.6008	0.2856	0.4214	0.3404
IFlessEquals	4,447	736	908	1,688	7,779	0.6663	0.7249	0.8304	0.7741
IFless	539	4,825	1,310	1,105	7,779	0.6895	0.3279	0.2915	0.3086
Total	14,708	17,636	7,073	10,001	49,418	0.6545	0.5952	0.6753	0.6327

Table 2: Performance metrics of the model trained specifically for *if* statements.