|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID | Applications | Strings in domain name | Flows | Packets |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | Google | google | 16149 | 136279 |
| 2 | Twitter | twitter, twimg | 7613 | 257206 |
| 3 | Youtube | youtube | 2031 | 202882 |
| 4 | Outlook | live.com | 1661 | 20649 |
| 5 | Github | github | 1320 | 26905 |
| 6 | Facebook | facebook | 717 | 14787 |
| 7 | Slack | slack | 888 | 17655 |
| 8 | Bing | bing | 901 | 38182 |
|  | Other labeled apps |  | 10899 | 230498 |

google twitter youtube outlook github facebook slack bing

google

twitter

youtube

outlook

github

facebook

slack

bing

126

560

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | google | twitter | youtube | outlook | github | facebook | slack | bing |
| google | 66 | 0 | 0 | 0 | 1 | 1 | 0 | 2 |
| twitter | 0 | 65 | 0 | 1 | 3 | 0 | 2 | 0 |
| youtube | 0 | 0 | 52 | 0 | 0 | 0 | 0 | 7 |
| outlook | 3 | 0 | 0 | 64 | 0 | 0 | 0 | 0 |
| github | 0 | 0 | 0 | 0 | 66 | 0 | 6 | 1 |
| facebook | 0 | 0 | 0 | 0 | 2 | 74 | 4 | 0 |
| slack | 0 | 0 | 0 | 0 | 7 | 1 | 60 | 0 |
| bing | 0 | 0 | 3 | 1 | 0 | 1 | 1 | 66 |

acc = [0.39638447940244453, 0.62742504409171074, 0.81393298059964725, 0.88712522024830809, 0.92438271594425991, 0.95502645534182351, 0.97574955929313811, 0.98015873015873012, 0.98192239869418807, 0.98897707241552846, 0.98875661396685943, 0.98919753086419748, 0.9907407407407407, 0.99272486782999059, 0.99426807760141089, 0.99294532648890532, 0.99184303350970016, 0.99294532659402812, 0.99382716049382713, 0.99338624338624337, 0.99514991181657853, 0.99537037047549315, 0.99514991202682412, 0.99382716049382713, 0.99559082892416229, 0.99404761915274187, 0.99537037037037035, 0.99603174603174605, 0.99669312179824454, 0.99647266313932981, 0.99647266324445261, 0.99735449735449733, 0.99647266313932981, 0.99603174603174605, 0.99647266313932981, 0.99537037037037035, 0.9971340389058283, 0.99757495590828926, 0.9971340388007055, 0.9971340389058283, 0.99779541446208109, 0.99757495601341206, 0.99867724867724872, 0.99757495590828926, 0.99735449735449733, 0.99735449735449733, 0.9971340388007055, 0.99845679012345678, 0.99757495590828926, 0.9993386243386243, 0.99889770723104054, 0.99823633156966485, 0.99845679012345678, 0.99823633156966485, 0.99845679012345678, 0.99911816578483248, 0.9993386243386243, 0.99845679012345678, 0.99911816578483248, 0.99977954144620806, 0.99911816578483248, 0.9993386243386243, 0.99867724867724872, 0.99977954144620806, 0.99977954144620806, 0.99889770723104054, 0.99867724867724872, 0.99955908289241624, 0.9993386243386243, 0.9993386243386243, 1.0, 0.99977954144620806, 0.99889770723104054, 0.9993386243386243, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 0.99977954144620806, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 0.99955908289241624, 0.99801587301587302, 1.0, 0.99977954144620806, 1.0, 1.0, 0.99977954144620806, 1.0, 0.99955908289241624, 1.0, 0.99955908289241624, 1.0]

val\_acc = [0.46230158588242909, 0.76984126889516435, 0.81944444728276089, 0.84920634826024377, 0.8690476162093026, 0.86507936318715417, 0.86904762188593543, 0.87896825112993759, 0.87103174319342958, 0.87500000283831647, 0.87698412414581062, 0.88293651077482438, 0.88095238284459187, 0.88690476474307833, 0.88690476474307833, 0.87896825112993759, 0.88293650604429696, 0.89484127267958624, 0.89087301776522687, 0.8968253987176078, 0.89484127267958624, 0.88293650509819155, 0.89087301776522687, 0.8988095266478402, 0.90079365268586176, 0.89285714569545926, 0.89484126794905894, 0.88095238000627552, 0.89087301398080487, 0.89484126794905894, 0.89880952097120737, 0.89682539966371322, 0.89484126794905894, 0.89682539493318592, 0.88095238000627552, 0.8888888869966779, 0.88293650699040249, 0.89484127267958624, 0.89682539398708039, 0.90277778061609415, 0.89484126794905894, 0.88293650604429696, 0.89285714191103738, 0.88888888794278342, 0.90277777493946132, 0.87896825207604301, 0.87301587112366208, 0.85912698318087866, 0.89285714569545926, 0.87698412414581062, 0.89285714569545926, 0.89285714569545926, 0.87698412982244345, 0.89087301303469946, 0.89682539966371322, 0.88888889172720531, 0.87301587017755655, 0.88095237906016999, 0.90079364795533434, 0.88492063208231853, 0.88293650509819155, 0.89682539398708039, 0.88492063208231853, 0.89682539398708039, 0.90079364795533434, 0.90476190760022113, 0.88888889172720531, 0.89087301303469946, 0.90674603363824269, 0.89682539398708039, 0.8988095266478402, 0.90079364795533434, 0.90079365268586176, 0.88690476379697281, 0.90277778061609415, 0.8988095266478402, 0.89880952570173478, 0.90277777966998873, 0.8968253987176078, 0.89682539966371322, 0.8968253987176078, 0.90674603269213727, 0.90476190760022113, 0.89682539966371322, 0.90277777872388321, 0.90674603269213727, 0.90476190570801018, 0.90079365173975623, 0.90476190665411571, 0.90674603269213727, 0.90674603363824269, 0.91865079459689913, 0.90277778061609415, 0.90674603269213727, 0.90079365173975623, 0.91269841269841268, 0.88888888605057248, 0.90674603269213727, 0.90476190665411571, 0.9126984136445182]

loss = [2.4068861772984635, 1.9946499930487738, 1.6362912825175695, 1.4837432691870123, 1.4147392887707531, 1.3513979556489033, 1.3189882182990853, 1.3066226193513819, 1.3017109792278767, 1.2927164558380368, 1.289290674149044, 1.2871316911051514, 1.2849301463502214, 1.2819311282411874, 1.2803080636988242, 1.2801234415178786, 1.2799548112526142, 1.27827963564131, 1.2775305328755993, 1.2781436611525385, 1.2757071159924569, 1.2770045249340185, 1.2746394658214832, 1.2760239917344727, 1.2741469510648615, 1.275181992764616, 1.2732781834072537, 1.2724605043939392, 1.2725421047294792, 1.272013462620017, 1.2729327994048911, 1.2714106117817039, 1.2729570327402213, 1.2714401969203242, 1.2712780762812028, 1.2719822926496072, 1.2708152208799197, 1.2696430113370245, 1.26972833722567, 1.2710658141544886, 1.2702408558056679, 1.2690275497537442, 1.2685404086659615, 1.2699177317728652, 1.268736793881371, 1.2694653640558691, 1.2703077330580885, 1.2678811117034321, 1.2699697858652319, 1.2678802665158764, 1.2680502064013608, 1.2688902797312123, 1.2677269433961764, 1.2683178423994221, 1.2683859792335954, 1.2667491730348563, 1.2668315029228385, 1.2672973436022561, 1.2669063465935844, 1.2657586073328788, 1.2667515368268183, 1.2657376079962999, 1.2673187300010964, 1.2658942199888683, 1.2653051759830858, 1.2663250228084584, 1.2675908137461076, 1.2655657418400732, 1.2657294067335718, 1.265762323845421, 1.2647938179591345, 1.2650985793461875, 1.2657975963394057, 1.2688531137648082, 1.2653033270827467, 1.2644675799778529, 1.2642555606848769, 1.2643601002937062, 1.2640937709724251, 1.2641699101769315, 1.2643361261912756, 1.2638844112870555, 1.2640321309394096, 1.2640321170631961, 1.2639014725121662, 1.2641909330610246, 1.2638292337851549, 1.2637553473629017, 1.2647927835504844, 1.2681239084381695, 1.2647310335589885, 1.2650453615440893, 1.2641341169044453, 1.2642126472328497, 1.2644994210524114, 1.2640995600866893, 1.2646552547155445, 1.2640036674613886, 1.264144026833657, 1.2641362029618897]

val\_loss = [2.2249909052773127, 1.7499023070411077, 1.5864084334600539, 1.5451536538108948, 1.5058397962933494, 1.5107314000054011, 1.5260486300029452, 1.5126470421987868, 1.5179152450864277, 1.5090197835649763, 1.5060769281690083, 1.5074371818512204, 1.5101683783152746, 1.5038896326034787, 1.495857452589368, 1.4955944220225017, 1.4946567671639579, 1.4777399377217368, 1.4864433644309876, 1.4799163303677998, 1.4705606320547679, 1.4777991279723153, 1.4784938418675984, 1.4815348538141402, 1.4788747496075101, 1.4820144195405265, 1.4745992403181771, 1.4813875451920524, 1.4886240523958962, 1.4830467227905515, 1.4782553646299574, 1.4749277470603821, 1.490398367245992, 1.4843298121104165, 1.5050237651855227, 1.4889132106114948, 1.493309741928464, 1.4849869334508503, 1.4837685690985785, 1.4825327169327509, 1.4782691247879514, 1.4952550766960022, 1.4991035385737344, 1.491127125800602, 1.471606663295201, 1.5144522379315088, 1.5195890456911116, 1.5544568905754694, 1.5124250915315416, 1.5288908027467274, 1.513176921814207, 1.5159186124801636, 1.5287335505561224, 1.510727670457628, 1.5024914325229706, 1.5083082952196636, 1.5233174921974304, 1.5162931869900416, 1.5036533446539015, 1.4991095766188607, 1.498808913760715, 1.5018825966214377, 1.5135987296937004, 1.5026307616915022, 1.4994424032786535, 1.4855819032305764, 1.5110933383305867, 1.5010209802597287, 1.4737071271926638, 1.4927370396871416, 1.4925815302228171, 1.4764029733718387, 1.4888315276494102, 1.4984197673343478, 1.4730568386259533, 1.4667169593629383, 1.4809374922797793, 1.4701726342004442, 1.4714766930020045, 1.4799808623298767, 1.471967241120717, 1.463430885284666, 1.4787009973374625, 1.477591385917058, 1.4738067975119939, 1.4702585027331398, 1.4700856341256037, 1.4680379875122556, 1.4668746827140686, 1.4739546529830447, 1.4638810933582367, 1.4406066205766466, 1.4594524228383625, 1.4538436957768031, 1.4638346868848044, 1.4516332660402571, 1.4693883525000677, 1.4508615334828694, 1.4569413321358817, 1.4562423550893391]

timeused: 0.11284017562866211

['loss', 'acc']

score [0.92073892865862161, 0.91607142857142854]

66 0 0 0 1 1 0 2

0 65 0 1 3 0 2 0

0 0 52 0 0 0 0 7

3 0 0 64 0 0 0 0

0 0 0 0 66 0 6 1

0 0 0 0 2 74 4 0

0 0 0 0 7 1 60 0

0 0 3 1 0 1 1 66

[[564 0 0 0 0 0 0 0]

[ 0 578 0 0 0 0 0 0]

[ 0 0 584 0 0 0 0 0]

[ 0 0 0 575 0 0 0 0]

[ 0 0 0 0 557 0 0 0]

[ 0 0 0 0 0 562 0 0]

[ 0 0 0 0 0 0 569 0]

[ 0 0 0 0 0 0 0 547]]

|  |  |  |  |
| --- | --- | --- | --- |
|  | Precision | recall | F1 |
| Google | 0.9565217391304348 | 0.9428571428571428 | 0.9496402877697843 |
| Twitter | 1.0 | 0.9154929577464789 | 0.9558823529411764 |
| Youtube | 0.9454545454545454 | 0.8813559322033898 | 0.9122807017543859 |
| Outlook | 0.9696969696969697 | 0.9552238805970149 | 0.9624060150375939 |
| Github | 0.8354430379746836 | 0.9041095890410958 | 0.8684210526315789 |
| Facebook | 0.961038961038961 | 0.925 | 0.9426751592356688 |
| Slack | 0.821917808219178 | 0.8823529411764706 | 0.8510638297872339 |
| Bing | 0.868421052631579 | 0.9166666666666666 | 0.8918918918918918 |

决策树 88.7

[[630 0 0 0 0 0 0 0]

[ 0 629 0 0 0 0 0 0]

[ 0 0 623 0 0 0 0 0]

[ 0 0 0 633 0 0 0 0]

[ 0 0 0 0 627 0 0 0]

[ 0 0 0 0 0 620 0 0]

[ 0 0 0 0 0 0 632 0]

[ 0 0 0 0 0 0 0 646]]

[[66 0 0 0 2 1 0 1]

[ 1 62 0 0 4 0 4 0]

[ 0 0 72 0 0 1 0 4]

[ 1 1 0 61 0 3 0 1]

[ 2 8 0 2 50 2 7 2]

[ 0 2 0 0 1 77 0 0]

[ 0 0 0 1 3 2 61 1]

[ 0 0 3 2 1 0 0 48]]

train acc: 1.0

test acc 0.8875

test acc: [0.88749999999999996]