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1.) Project Information:

In this project we will study the impact of gap open penalty and alignment score threshold on alignment accuracy.

We are using 10 datasets of simulated sequences of human, chimpanzee, dog, and mouse.

Each dataset contains four genomics sequences and three true alignment files: human vs. chimpanzee, human vs. dog, and human vs. mouse. You will use a pipeline of pairwise alignment tools to produce computed pairwise alignment, and then compare such alignment with true alignment file to determine accuracy of the computed alignment. Alignment accuracy is defined by sensitivity and specificity.

2.) Introduction:

So far in project 1 and 2, we have learned what is Genome. Genome is encoded into four types of DNA bases and we use the first letter of each to represent them. The four Alphabets are A, C, G and T. So, genomes are long strings containing these four alphabets.

We have learnt that all species have experienced a long history of evolution. And couple of these evolutionary events have occurred because of insertion / deletion (indel; as we cannot establish for a fact whether there was an insertion or deletion and hence, we call it indel) substitution and few more like duplication, translocation and transposition. But in this project, we are just concentrating on substitution.

Substitution is a type where one base is transformed to another (A – G, A – T, A –C, G – A, G – C, G – T, C – A, C – G, C – T, T – A, T – C and T – G). There are two types in substitution:

Transition: When substitution between A – G and C – T occurs.

Transversion: Rest all the types of substitution.

Also, we have learnt that an indel is often referred as a gap and it is represented using '-'.
A sequence of contiguous '-' characters is counted as one gap. The gap length refers to the number of '-' characters in the gap.

We have learnt there are 7 regions Exon, Intron, Intergenic, Coding, 5'UTR, 3'UTR and Promotor. And how based on Promotor base the values of match, mismatch, gap rate varies.

In this project what we are concentrating is the position information of each "letter" (i.e., a base) in the alignment block, rather than what the letter is.

The pair of input sequences are X and Y, and each sequence has m and n bases respectively:

X: x1, x2, ..., xm
Y: y1, y2, ..., yn

Suppose xi is aligned to yj in true alignment, and xi is aligned to yj' in computed alignment. If $|j - j'| \leq$ c, where c is a constant (default value is 5), we consider xi and yj' correctly aligned.

Let F be the file of computed alignment, and T be the file of true alignment. An aligned position in a pairwise alignment refers to a match or mismatch. We then have:

Sensitivity = correctly-aligned-positions-in-F/all-aligned-positions-in-T

Specificity = correctly-aligned-positions-in-F/all-aligned-positions-in-F

Also, in this project we are using two parameters *'K' i.e. "Alignment Score Cut off" (values being 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000)* and *'O' i.e.* "*Gap Open Penalty* " (*Values being 100, 150, 200, 250, 300, 350, 400, 450, 500*) and comparing the sensitivity and specificity.

3.) Programming Language Used:

For this project I have used C++ as my programming language. I took around 6 hours to code and around 2 - 3 hours to debug and modify. I took around an hour to write the shell script and around another 3 hours to write the report.

Used the Command g++ -o <execution file name> <program name.cc> to compile the program.

I have modified the provided shell script so, I can execute for all the parameters at a time, instead of compiling it every time, by changing the parameter. I will attach the shell script as well when uploading the source code.

4.) Findings:

When I executed the following findings were made:

1.) **For Dateset01**

a.) Human Chimp File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	52948	52944	52941	0.999868	0.999943
K=3000, O=400, C=0	52948	52944	52824	0.997658	0.997733
K=3000, O=300, C=5	52948	52944	52941	0.999868	0.999943
K=3000, O=300, C=0	52948	52944	52824	0.997658	0.997733
K=3000, O=500, C=5	52948	52944	52941	0.999868	0.999943
K=3000, O=500, C=0	52948	52944	52824	0.997658	0.997733
K=5000, O=400, C=5	52948	52944	52941	0.999868	0.999943
K=5000, O=400, C=0	52948	52944	52824	0.997658	0.997733
K=5000, O=300,C=5	52948	52944	52941	0.999868	0.999943
K=5000, O=300,C=0	52948	52944	52824	0.997658	0.997733
K=5000, O=500, C=5	52948	52944	52941	0.999868	0.999943
K=5000, O=500, C=0	52948	52944	52824	0.997658	0.997733
K=2000, O=400, C=5	52948	52944	52941	0.999868	0.999943
K=2000, O=400, C=0	52948	52944	52824	0.997658	0.997733
K=2000, O=300, C=5	52948	52944	52941	0.999868	0.999943
K=2000, O=300, C=0	52948	52944	52824	0.997658	0.997733
K=2000, O=500, C=5	52948	52944	52941	0.999868	0.999943
K=2000, O=500, C=0	52948	52944	52824	0.997658	0.997733
Average	**52948**	**52944**	**52882.5**	**0.998763**	**0.998838**

b.) Human Dog File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	52948	44253	38708	0.731057	0.874698
K=3000, O=400, C=0	52948	44253	33046	0.624122	0.746752
K=3000, O=300, C=5	52948	50885	37768	0.713304	0.742223
K=3000, O=300, C=0	52948	50885	32450	0.612865	0.637712
K=3000, O=500, C=5	52948	42563	39296	0.742162	0.923243
K=3000, O=500, C=0	52948	42563	33452	0.63179	0.785941
K=5000, O=400, C=5	52948	44156	38611	0.729225	0.874422
K=5000, O=400, C=0	52948	44156	32955	0.622403	0.746331
K=5000, O=300,C=5	52948	50560	37768	0.713304	0.746994
K=5000, O=300,C=0	52948	50560	32450	0.612865	0.641812
K=5000, O=500, C=5	52948	40015	36847	0.695909	0.92083
K=5000, O=500, C=0	52948	40015	31495	0.594829	0.78708
K=2000, O=400, C=5	52948	44942	39377	0.743692	0.876174
K=2000, O=400, C=0	52948	44942	33505	0.632791	0.745516
K=2000, O=300, C=5	52948	52168	38334	0.723993	0.734818
K=2000, O=300, C=0	52948	52168	32796	0.6194	0.628661
K=2000, O=500, C=5	52948	43038	39765	0.75102	0.923951
K=2000, O=500, C=0	52948	43038	33900	0.640251	0.787676
Average	**52948**	**45842.22**	**33648.67**	**0.674166**	**0.784713**

c.) Human Mouse File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	52948	19277	15352	0.289945	0.796389
K=3000, O=400, C=0	52948	19277	12198	0.230377	0.632775
K=3000, O=300, C=5	52948	27327	17152	0.32394	0.627658
K=3000, O=300, C=0	52948	27327	13222	0.249717	0.483844
K=3000, O=500, C=5	52948	13787	12314	0.232568	0.89316
K=3000, O=500, C=0	52948	13787	9765	0.184426	0.708276
K=5000, O=400, C=5	52948	2268	1997	0.0377163	0.880511
K=5000, O=400, C=0	52948	2268	1599	0.0301994	0.705026
K=5000, O=300,C=5	52948	5554	2074	0.0391705	0.373425
K=5000, O=300,C=0	52948	5554	1666	0.0314648	0.299964
K=5000, O=500, C=5	52948	2268	2018	0.0381129	0.889771
K=5000, O=500, C=0	52948	2268	1622	0.0306338	0.715168
K=2000, O=400, C=5	52948	28563	22889	0.432292	0.801351
K=2000, O=400, C=0	52948	28563	18217	0.344055	0.637783
K=2000, O=300, C=5	52948	36484	22415	0.42334	0.614379
K=2000, O=300, C=0	52948	36484	17231	0.325433	0.472289
K=2000, O=500, C=5	52948	23704	20549	0.388098	0.8669
K=2000, O=500, C=0	52948	23704	16248	0.306867	0.685454
Average	**52948**	**17692.44**	**11584.9**	**0.218798**	**0.67134**

2.) For Dateset02

a.) Human Chimp File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	58012	58006	58004	0.999862	0.999966
K=3000, O=400, C=0	58012	58006	57506	0.991278	0.99138
K=3000, O=300, C=5	58012	58006	58004	0.999862	0.999966
K=3000, O=300, C=0	58012	58006	57506	0.991278	0.99138
K=3000, O=500, C=5	58012	58006	58004	0.999862	0.999966
K=3000, O=500, C=0	58012	58006	57506	0.991278	0.99138
K=5000, O=400, C=5	58012	58006	58004	0.999862	0.999966
K=5000, O=400, C=0	58012	58006	57506	0.991278	0.99138
K=5000, O=300,C=5	58012	58006	58004	0.999862	0.999966
K=5000, O=300,C=0	58012	58006	57506	0.991278	0.99138
K=5000, O=500, C=5	58012	58006	58004	0.999862	0.999966
K=5000, O=500, C=0	58012	58006	57506	0.991278	0.99138
K=2000, O=400, C=5	58012	58006	58004	0.999862	0.999966
K=2000, O=400, C=0	58012	58006	57506	0.991278	0.99138
K=2000, O=300, C=5	58012	58006	58004	0.999862	0.999966
K=2000, O=300, C=0	58012	58006	57506	0.991278	0.99138
K=2000, O=500, C=5	58012	58006	58004	0.999862	0.999966
K=2000, O=500, C=0	58012	58006	57506	0.991278	0.99138
Average	**58012**	**58006**	**57755**	**0.99557**	**0.995673**

b.) Human Dog File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	58012	42761	38045	0.655813	0.889713
K=3000, O=400, C=0	58012	42761	31974	0.551162	0.747737
K=3000, O=300, C=5	58012	49090	35800	0.617114	0.729273
K=3000, O=300, C=0	58012	49090	29800	0.513687	0.607048
K=3000, O=500, C=5	58012	41525	37679	0.649504	0.907381
K=3000, O=500, C=0	58012	41525	31864	0.549266	0.767345
K=5000, O=400, C=5	58012	34730	30827	0.53139	0.887619
K=5000, O=400, C=0	58012	34730	25608	0.441426	0.737345
K=5000, O=300,C=5	58012	43091	30288	0.522099	0.702885
K=5000, O=300,C=0	58012	43091	24983	0.430652	0.579773
K=5000, O=500, C=5	58012	31373	28177	0.48571	0.898129
K=5000, O=500, C=0	58012	31373	23534	0.405675	0.750135
K=2000, O=400, C=5	58012	42761	38044	0.655795	0.889689
K=2000, O=400, C=0	58012	42761	31963	0.550972	0.74748
K=2000, O=300, C=5	58012	49090	35799	0.617096	0.729252
K=2000, O=300, C=0	58012	49090	29791	0.513532	0.606865
K=2000, O=500, C=5	58012	41640	37793	0.651469	0.907613
K=2000, O=500, C=0	58012	41640	31962	0.550955	0.767579
Average	**58012**	**41784.6**	**31885.1**	**0.549629**	**0.7696**

c.) Human Mouse File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	58012	22247	17152	0.295663	0.77098
K=3000, O=400, C=0	58012	22247	12967	0.223523	0.582865
K=3000, O=300, C=5	58012	30966	19333	0.333259	0.62433
K=3000, O=300, C=0	58012	30966	15095	0.260205	0.48747
K=3000, O=500, C=5	58012	20395	16372	0.282217	0.802746
K=3000, O=500, C=0	58012	23095	12624	0.21761	0.618975
K=5000, O=400, C=5	58012	12840	10692	0.184307	0.83271
K=5000, O=400, C=0	58012	12840	7891	0.136024	0.614564
K=5000, O=300,C=5	58012	18611	12116	0.208853	0.651013
K=5000, O=300,C=0	58012	18611	9332	0.160863	0.501424
K=5000, O=500, C=5	58012	8568	7693	0.13261	0.897876
K=5000, O=500, C=0	58012	8568	5727	0.098721	0.668417
K=2000, O=400, C=5	58012	29870	22809	0.393177	0.763609
K=2000, O=400, C=0	58012	29870	17450	0.3008	0.584198
K=2000, O=300, C=5	58012	35607	20711	0.357012	0.581655
K=2000, O=300, C=0	58012	35607	16275	0.280545	0.457073
K=2000, O=500, C=5	58012	26594	22059	0.380249	0.829473
K=2000, O=500, C=0	58012	26594	17030	0.29356	0.64037
Average	**58012**	**23005.3**	**14629.3**	**0.252178**	**0.66165**

3.) For Dateset03

a.) Human Chimp File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	57116	57112	57106	0.999825	0.999895
K=3000, O=400, C=0	57116	57112	56670	0.992191	0.992261
K=3000, O=300, C=5	57116	57112	56121	0.982579	0.982648
K=3000, O=300, C=0	57116	57112	55785	0.976697	0.976765
K=3000, O=500, C=5	57116	57112	57106	0.999825	0.999895
K=3000, O=500, C=0	57116	57112	56670	0.992191	0.992261
K=5000, O=400, C=5	57116	57112	57106	0.999825	0.999895
K=5000, O=400, C=0	57116	57112	56670	0.992191	0.992261
K=5000, O=300,C=5	57116	57112	56121	0.982579	0.982648
K=5000, O=300,C=0	57116	57112	55785	0.976697	0.976765
K=5000, O=500, C=5	57116	57112	57106	0.999825	0.999895
K=5000, O=500, C=0	57116	57112	56670	0.992191	0.992261
K=2000, O=400, C=5	57116	57112	57106	0.999825	0.999895
K=2000, O=400, C=0	57116	57112	56670	0.992191	0.992261
K=2000, O=300, C=5	57116	57112	56121	0.982579	0.982648
K=2000, O=300, C=0	57116	57112	55785	0.976697	0.976765
K=2000, O=500, C=5	57116	57112	57106	0.999825	0.999895
K=2000, O=500, C=0	57116	57112	56670	0.992191	0.992261
Average	**57716**	**57112**	**56576.3**	**0.99055**	**0.990621**

b.) Human Dog File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	57116	47318	41290	0.722915	0.872607
K=3000, O=400, C=0	57116	47318	34073	0.596558	0.720085
K=3000, O=300, C=5	57116	49711	39622	0.693711	0.797047
K=3000, O=300, C=0	57116	49711	32776	0.57385	0.659331
K=3000, O=500, C=5	57116	46727	41346	0.723895	0.884842
K=3000, O=500, C=0	57116	46727	34070	0.596505	0.729129
K=5000, O=400, C=5	57116	40551	35115	0.614801	0.865947
K=5000, O=400, C=0	57116	40551	28844	0.505007	0.711302
K=5000, O=300,C=5	57116	47128	37128	0.650046	0.787812
K=5000, O=300,C=0	57116	47128	30716	0.537783	0.651757
K=5000, O=500, C=5	57116	39960	35158	0.615554	0.87983
K=5000, O=500, C=0	57116	39960	28840	0.504937	0.721722
K=2000, O=400, C=5	57116	48222	42075	0.736659	0.872527
K=2000, O=400, C=0	57116	48222	34729	0.608043	0.72019
K=2000, O=300, C=5	57116	51333	40410	0.707508	0.787213
K=2000, O=300, C=0	57116	51333	33508	0.586666	0.652757
K=2000, O=500, C=5	57116	47631	42116	0.737377	0.884214
K=2000, O=500, C=0	57116	47631	34701	0.607553	0.728538
Average	**57116**	**46509**	**35917.6**	**0.628854**	**0.77371**

c.) Human Mouse File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	57116	17110	12085	0.211587	0.706312
K=3000, O=400, C=0	57116	17110	9545	0.167116	0.557861
K=3000, O=300, C=5	57116	26488	15305	0.267963	0.577809
K=3000, O=300, C=0	57116	26488	11564	0.202465	0.436575
K=3000, O=500, C=5	57116	11343	8658	0.151586	0.76329
K=3000, O=500, C=0	57116	11343	6942	0.121542	0.612007
K=5000, O=400, C=5	57116	0	0	0	0
K=5000, O=400, C=0	57116	0	0	0	0
K=5000, O=300,C=5	57116	0	0	0	0
K=5000, O=300,C=0	57116	0	0	0	0
K=5000, O=500, C=5	57116	0	0	0	0
K=5000, O=500, C=0	57116	0	0	0	0
K=2000, O=400, C=5	57116	25699	18684	0.327124	0.727032
K=2000, O=400, C=0	57116	25699	14415	0.252381	0.560917
K=2000, O=300, C=5	57116	29831	17713	0.310123	0.593778
K=2000, O=300, C=0	57116	29831	13317	0.233157	0.446415
K=2000, O=500, C=5	57116	18968	15178	0.26574	0.80019
K=2000, O=500, C=0	57116	18968	11857	0.207595	0.625105
Average	**57116**	**14382.1**	**8625.72**	**0.141662**	**0.41152**

4.) For Dateset04

a.) Human Chimp File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	65160	65156	65151	0.999862	0.999923
K=3000, O=400, C=0	65160	65156	65036	0.998097	0.998158
K=3000, O=300, C=5	65160	65156	65126	0.999478	0.99954
K=3000, O=300, C=0	65160	65156	65011	0.997713	0.997775
K=3000, O=500, C=5	65160	65156	65151	0.999862	0.999923
K=3000, O=500, C=0	65160	65156	65036	0.998097	0.998158
K=5000, O=400, C=5	65160	65156	65151	0.999862	0.999923
K=5000, O=400, C=0	65160	65156	65036	0.998097	0.998158
K=5000, O=300,C=5	65160	65156	65126	0.999478	0.99954
K=5000, O=300,C=0	65160	65156	65011	0.997713	0.997775
K=5000, O=500, C=5	65160	65156	65151	0.999862	0.999923
K=5000, O=500, C=0	65160	65156	65036	0.998097	0.998158
K=2000, O=400, C=5	65160	65156	65151	0.999862	0.999923
K=2000, O=400, C=0	65160	65156	65036	0.998097	0.998158
K=2000, O=300, C=5	65160	65156	65126	0.999478	0.99954
K=2000, O=300, C=0	65160	65156	65011	0.997713	0.997775
K=2000, O=500, C=5	65160	65156	65151	0.999862	0.999923
K=2000, O=500, C=0	65160	65156	65036	0.998097	0.998158
Average	**65160**	**65156**	**65085.2**	**0.99885**	**0.998913**

b.) Human Dog File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	65160	48351	43563	0.668554	0.900974
K=3000, O=400, C=0	65160	48351	35426	0.543677	0.732684
K=3000, O=300, C=5	65160	54386	41731	0.640439	0.767311
K=3000, O=300, C=0	65160	54386	34180	0.524555	0.628471
K=3000, O=500, C=5	65160	47744	43285	0.664288	0.906606
K=3000, O=500, C=0	65160	47744	35313	0.541943	0.739632
K=5000, O=400, C=5	65160	46480	41515	0.637124	0.89318
K=5000, O=400, C=0	65160	46480	33739	0.517787	0.725882
K=5000, O=300,C=5	65160	53490	40876	0.627317	0.76418
K=5000, O=300,C=0	65160	53490	33595	0.515577	0.628061
K=5000, O=500, C=5	65160	44781	41292	0.633702	0.922087
K=5000, O=500, C=0	65160	44781	33666	0.516667	0.751792
K=2000, O=400, C=5	65160	48814	44014	0.675476	0.901668
K=2000, O=400, C=0	65160	48814	35842	0.550061	0.734257
K=2000, O=300, C=5	65160	56059	41874	0.642633	0.746963
K=2000, O=300, C=0	65160	56059	34309	0.526535	0.612016
K=2000, O=500, C=5	65160	48197	43736	0.671209	0.907442
K=2000, O=500, C=0	65160	48197	35729	0.548327	0.741312
Average	**65160**	**49811.3**	**38538.1**	**0.594713**	**0.77803**

c.) Human Mouse File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	65160	13686	10153	0.155816	0.741853
K=3000, O=400, C=0	65160	13686	8223	0.126197	0.600833
K=3000, O=300, C=5	65160	29249	15769	0.242004	0.53913
K=3000, O=300, C=0	65160	29249	12363	0.189733	0.422681
K=3000, O=500, C=5	65160	10967	8426	0.129312	0.768305
K=3000, O=500, C=0	65160	10967	6859	0.105264	0.625422
K=5000, O=400, C=5	65160	2661	2222	0.0341007	0.835024
K=5000, O=400, C=0	65160	2661	1738	0.0266728	0.653138
K=5000, O=300,C=5	65160	6771	2038	0.0312769	0.30099
K=5000, O=300,C=0	65160	6771	1580	0.024248	0.233348
K=5000, O=500, C=5	65160	2661	2194	0.033671	0.824502
K=5000, O=500, C=0	65160	2661	1711	0.0262584	0.642991
K=2000, O=400, C=5	65160	25446	19810	0.304021	0.778511
K=2000, O=400, C=0	65160	25446	15834	0.243002	0.622259
K=2000, O=300, C=5	65160	34708	18066	0.277256	0.520514
K=2000, O=300, C=0	65160	34708	14062	0.215807	0.405152
K=2000, O=500, C=5	65160	22001	18270	0.280387	0.830417
K=2000, O=500, C=0	65160	22001	14630	0.224524	0.66497
Average	**65160**	**16461.1**	**9663.78**	**0.148308**	**0.61167**

5.) For Dateset05

a.) Human Chimp File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	62464	62460	62460	0.999936	1
K=3000, O=400, C=0	62464	62460	62304	0.997439	0.997502
K=3000, O=300, C=5	62464	62460	62460	0.999936	1
K=3000, O=300, C=0	62464	62460	62304	0.997439	0.997502
K=3000, O=500, C=5	62464	62460	62460	0.999936	1
K=3000, O=500, C=0	62464	62460	62304	0.997439	0.997502
K=5000, O=400, C=5	62464	62460	62460	0.999936	1
K=5000, O=400, C=0	62464	62460	62304	0.997439	0.997502
K=5000, O=300,C=5	62464	62460	62460	0.999936	1
K=5000, O=300,C=0	62464	62460	62304	0.997439	0.997502
K=5000, O=500, C=5	62464	62460	62460	0.999936	1
K=5000, O=500, C=0	62464	62460	62304	0.997439	0.997502
K=2000, O=400, C=5	62464	62460	62460	0.999936	1
K=2000, O=400, C=0	62464	62460	62304	0.997439	0.997502
K=2000, O=300, C=5	62464	62460	62460	0.999936	1
K=2000, O=300, C=0	62464	62460	62304	0.997439	0.997502
K=2000, O=500, C=5	62464	62460	62460	0.999936	1
K=2000, O=500, C=0	62464	62460	62304	0.997439	0.997502
Average	**62464**	**62460**	**62382**	**0.99869**	**0.998751**

b.) Human Dog File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	62464	43021	36899	0.590724	0.857697
K=3000, O=400, C=0	62464	43021	31542	0.504963	0.733177
K=3000, O=300, C=5	62464	52912	36429	0.5832	0.688483
K=3000, O=300, C=0	62464	52912	31061	0.497262	0.587031
K=3000, O=500, C=5	62464	42600	37783	0.604876	0.886925
K=3000, O=500, C=0	62464	42600	31803	0.509141	0.746549
K=5000, O=400, C=5	62464	38436	32749	0.524286	0.85204
K=5000, O=400, C=0	62464	38436	27816	0.445312	0.723697
K=5000, O=300,C=5	62464	48860	31735	0.508053	0.649509
K=5000, O=300,C=0	62464	48860	26876	0.430264	0.550061
K=5000, O=500, C=5	62464	35116	30807	0.493196	0.877292
K=5000, O=500, C=0	62464	35116	25996	0.416176	0.740289
K=2000, O=400, C=5	62464	45484	38100	0.609951	0.837657
K=2000, O=400, C=0	62464	45484	32603	0.521949	0.716802
K=2000, O=300, C=5	62464	52912	37249	0.596327	0.70398
K=2000, O=300, C=0	62464	52912	31791	0.508949	0.600828
K=2000, O=500, C=5	62464	45063	38984	0.624103	0.8651
K=2000, O=500, C=0	62464	45063	32862	0.526095	0.729246
Average	**62464**	**44933.8**	**32949.2**	**0.52749**	**0.74146**

c.) Human Mouse File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	62464	28325	23296	0.372951	0.822454
K=3000, O=400, C=0	62464	28325	17910	0.286725	0.632304
K=3000, O=300, C=5	62464	41766	26678	0.427094	0.638749
K=3000, O=300, C=0	62464	41766	19983	0.319912	0.478451
K=3000, O=500, C=5	62464	25826	21843	0.349689	0.845776
K=3000, O=500, C=0	62464	25826	17137	0.27435	0.663556
K=5000, O=400, C=5	62464	0	0	0	0
K=5000, O=400, C=0	62464	0	0	0	0
K=5000, O=300,C=5	62464	0	0	0	0
K=5000, O=300,C=0	62464	0	0	0	0
K=5000, O=500, C=5	62464	0	0	0	0
K=5000, O=500, C=0	62464	0	0	0	0
K=2000, O=400, C=5	62464	38904	31849	0.509878	0.818656
K=2000, O=400, C=0	62464	38904	24777	0.39666	0.636875
K=2000, O=300, C=5	62464	51374	31431	0.503186	0.611808
K=2000, O=300, C=0	62464	51374	23643	0.378506	0.460213
K=2000, O=500, C=5	62464	28269	24311	0.3892	0.859988
K=2000, O=500, C=0	62464	28269	19118	0.306064	0.676288
Average	**62464**	**23829.3**	**15665.3**	**0.25079**	**0.45251**

6.) For Dateset06

a.) Human Chimp File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	49514	49510	49332	0.996324	0.996405
K=3000, O=400, C=0	49514	49510	49158	0.99281	0.99289
K=3000, O=300, C=5	49514	49510	49318	0.996042	0.996122
K=3000, O=300, C=0	49514	49510	49144	0.992527	0.992608
K=3000, O=500, C=5	49514	49510	49332	0.996324	0.996405
K=3000, O=500, C=0	49514	49510	49158	0.99281	0.99289
K=5000, O=400, C=5	49514	49510	49332	0.996324	0.996405
K=5000, O=400, C=0	49514	49510	49158	0.99281	0.99289
K=5000, O=300,C=5	49514	49510	49318	0.996042	0.996122
K=5000, O=300,C=0	49514	49510	49144	0.992527	0.992608
K=5000, O=500, C=5	49514	49510	49332	0.996324	0.996405
K=5000, O=500, C=0	49514	49510	49158	0.99281	0.99289
K=2000, O=400, C=5	49514	49510	49332	0.996324	0.996405
K=2000, O=400, C=0	49514	49510	49158	0.99281	0.99289
K=2000, O=300, C=5	49514	49510	49318	0.996042	0.996122
K=2000, O=300, C=0	49514	49510	49144	0.992527	0.992608
K=2000, O=500, C=5	49514	49510	49332	0.996324	0.996405
K=2000, O=500, C=0	49514	49510	49158	0.99281	0.99289
Average	**49514**	**49510**	**49240.3**	**0.99447**	**0.994553**

b.) Human Dog File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	49514	37602	34194	0.690593	0.909367
K=3000, O=400, C=0	49514	37602	28446	0.574504	0.756502
K=3000, O=300, C=5	49514	40254	33708	0.680777	0.837383
K=3000, O=300, C=0	49514	40254	27836	0.562184	0.691509
K=3000, O=500, C=5	49514	36156	34131	0.68932	0.943993
K=3000, O=500, C=0	49514	36156	28398	0.573535	0.78543
K=5000, O=400, C=5	49514	25092	22580	0.456033	0.899888
K=5000, O=400, C=0	49514	25092	18667	0.377004	0.743942
K=5000, O=300,C=5	49514	30236	22599	0.456416	0.74742
K=5000, O=300,C=0	49514	30236	18540	0.37444	0.613176
K=5000, O=500, C=5	49514	21834	20788	0.419841	0.952093
K=5000, O=500, C=0	49514	21834	17350	0.350406	0.794632
K=2000, O=400, C=5	49514	37602	34194	0.690593	0.909367
K=2000, O=400, C=0	49514	37602	28446	0.574504	0.756502
K=2000, O=300, C=5	49514	40254	33708	0.680777	0.837383
K=2000, O=300, C=0	49514	40254	27836	0.562184	0.691509
K=2000, O=500, C=5	49514	36156	34131	0.68932	0.943993
K=2000, O=500, C=0	49514	36156	28398	0.573535	0.78543
Average	**49514**	**33909.6**	**27441.7**	**0.55422**	**0.81108**

c.) Human Mouse File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	49514	7986	6520	0.13168	0.816429
K=3000, O=400, C=0	49514	7986	5162	0.104253	0.646381
K=3000, O=300, C=5	49514	12016	7602	0.153532	0.632656
K=3000, O=300, C=0	49514	12016	5895	0.119057	0.490596
K=3000, O=500, C=5	49514	7691	6556	0.132407	0.852425
K=3000, O=500, C=0	49514	7691	5091	0.102819	0.661943
K=5000, O=400, C=5	49514	0	0	0	0
K=5000, O=400, C=0	49514	0	0	0	0
K=5000, O=300,C=5	49514	0	0	0	0
K=5000, O=300,C=0	49514	0	0	0	0
K=5000, O=500, C=5	49514	0	0	0	0
K=5000, O=500, C=0	49514	0	0	0	0
K=2000, O=400, C=5	49514	19395	14943	0.301793	0.770456
K=2000, O=400, C=0	49514	19395	11963	0.241608	0.616808
K=2000, O=300, C=5	49514	23762	15163	0.306237	0.63812
K=2000, O=300, C=0	49514	23762	11821	0.238741	0.497475
K=2000, O=500, C=5	49514	17213	14256	0.287919	0.828211
K=2000, O=500, C=0	49514	17213	11259	0.22739	0.654099
Average	**49514**	**9784.78**	**6457.28**	**0.130413**	**0.45031**

7.) For Dateset07

a.) Human Chimp File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	51865	51861	51858	0.999865	0.999942
K=3000, O=400, C=0	51865	51861	51665	0.996144	0.996221
K=3000, O=300, C=5	51865	51861	51844	0.999595	0.999672
K=3000, O=300, C=0	51865	51861	51649	0.995835	0.995912
K=3000, O=500, C=5	51865	51861	51858	0.999865	0.999942
K=3000, O=500, C=0	51865	51861	51665	0.996144	0.996221
K=5000, O=400, C=5	51865	51861	51858	0.999865	0.999942
K=5000, O=400, C=0	51865	51861	51665	0.996144	0.996221
K=5000, O=300,C=5	51865	51861	51844	0.999595	0.999672
K=5000, O=300,C=0	51865	51861	51649	0.995835	0.995912
K=5000, O=500, C=5	51865	51861	51858	0.999865	0.999942
K=5000, O=500, C=0	51865	51861	51665	0.996144	0.996221
K=2000, O=400, C=5	51865	51861	51858	0.999865	0.999942
K=2000, O=400, C=0	51865	51861	51665	0.996144	0.996221
K=2000, O=300, C=5	51865	51861	51844	0.999595	0.999672
K=2000, O=300, C=0	51865	51861	51649	0.995835	0.995912
K=2000, O=500, C=5	51865	51861	51858	0.999865	0.999942
K=2000, O=500, C=0	51865	51861	51665	0.996144	0.996221
Average	**51865**	**51861**	**51756.5**	**0.99791**	**0.997985**

b.) Human Dog File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	51865	43240	37391	0.720929	0.864732
K=3000, O=400, C=0	51865	43240	31444	0.606266	0.727197
K=3000, O=300, C=5	51865	50894	34152	0.658479	0.671042
K=3000, O=300, C=0	51865	50894	28632	0.552049	0.562581
K=3000, O=500, C=5	51865	40962	36599	0.705659	0.893487
K=3000, O=500, C=0	51865	40962	30750	0.592885	0.750696
K=5000, O=400, C=5	51865	37469	32118	0.619262	0.857189
K=5000, O=400, C=0	51865	37469	26724	0.515261	0.71323
K=5000, O=300,C=5	51865	48542	32583	0.628227	0.671233
K=5000, O=300,C=0	51865	48542	27328	0.526906	0.562976
K=5000, O=500, C=5	51865	35098	31193	0.601427	0.88874
K=5000, O=500, C=0	51865	35098	25946	0.50026	0.739244
K=2000, O=400, C=5	51865	43691	37804	0.728892	0.865258
K=2000, O=400, C=0	51865	43691	31823	0.613574	0.728365
K=2000, O=300, C=5	51865	50124	33581	0.647469	0.669959
K=2000, O=300, C=0	51865	50124	28159	0.542929	0.561787
K=2000, O=500, C=5	51865	39101	35024	0.675292	0.895732
K=2000, O=500, C=0	51865	39101	29925	0.576979	0.765326
Average	**51865**	**43235.7**	**31732**	**0.611819**	**0.74382**

c.) Human Mouse File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	51865	23143	17253	0.332652	0.745495
K=3000, O=400, C=0	51865	23143	13451	0.259346	0.581212
K=3000, O=300, C=5	51865	29040	18710	0.360744	0.644284
K=3000, O=300, C=0	51865	29040	14552	0.280575	0.501102
K=3000, O=500, C=5	51865	17214	13891	0.26783	0.806959
K=3000, O=500, C=0	51865	17214	10843	0.209062	0.629894
K=5000, O=400, C=5	51865	9452	6682	0.128834	0.70694
K=5000, O=400, C=0	51865	9452	5223	0.100704	0.552581
K=5000, O=300,C=5	51865	19511	12433	0.239718	0.63723
K=5000, O=300,C=0	51865	19511	9492	0.183014	0.486495
K=5000, O=500, C=5	51865	3047	2689	0.0518461	0.882507
K=5000, O=500, C=0	51865	3047	2189	0.0422057	0.718412
K=2000, O=400, C=5	51865	30103	22914	0.441801	0.761187
K=2000, O=400, C=0	51865	30103	17882	0.34478	0.594027
K=2000, O=300, C=5	51865	34064	22131	0.426704	0.649689
K=2000, O=300, C=0	51865	34064	17266	0.332903	0.506869
K=2000, O=500, C=5	51865	26599	22076	0.425644	0.829956
K=2000, O=500, C=0	51865	26599	17429	0.336046	0.65525
Average	**51865**	**21352.6**	**13728.1**	**0.264689**	**0.66056**

8.) For Dateset08

a.) Human Chimp File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	49201	48680	48679	0.98939	0.999979
K=3000, O=400, C=0	49201	48680	48394	0.983598	0.994125
K=3000, O=300, C=5	49201	49197	48165	0.978944	0.979023
K=3000, O=300, C=0	49201	49197	47855	0.972643	0.972722
K=3000, O=500, C=5	49201	48680	48679	0.98939	0.999979
K=3000, O=500, C=0	49201	48680	48394	0.983598	0.994125
K=5000, O=400, C=5	49201	48680	48679	0.98939	0.999979
K=5000, O=400, C=0	49201	48680	48394	0.983598	0.994125
K=5000, O=300,C=5	49201	49197	48165	0.978944	0.979023
K=5000, O=300,C=0	49201	49197	47855	0.972643	0.972722
K=5000, O=500, C=5	49201	48680	48679	0.98939	0.999979
K=5000, O=500, C=0	49201	48680	48394	0.983598	0.994125
K=2000, O=400, C=5	49201	48680	48679	0.98939	0.999979
K=2000, O=400, C=0	49201	48680	48394	0.983598	0.994125
K=2000, O=300, C=5	49201	49197	48165	0.978944	0.979023
K=2000, O=300, C=0	49201	49197	47855	0.972643	0.972722
K=2000, O=500, C=5	49201	48680	48679	0.98939	0.999979
K=2000, O=500, C=0	49201	48680	48394	0.983598	0.994125
Average	**49201**	**48852.3**	**48361**	**0.982927**	**0.98999**

b.) Human Dog File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	49201	42145	36993	0.751875	0.877755
K=3000, O=400, C=0	49201	42145	30753	0.625048	0.729695
K=3000, O=300, C=5	49201	43610	36359	0.738989	0.833731
K=3000, O=300, C=0	49201	43610	30397	0.617813	0.697019
K=3000, O=500, C=5	49201	40134	36741	0.746753	0.915458
K=3000, O=500, C=0	49201	40134	30619	0.622325	0.762919
K=5000, O=400, C=5	49201	37755	34471	0.700616	0.913018
K=5000, O=400, C=0	49201	37755	28944	0.588281	0.766627
K=5000, O=300,C=5	49201	42264	35261	0.716672	0.834303
K=5000, O=300,C=0	49201	42264	29638	0.602386	0.701259
K=5000, O=500, C=5	49201	33909	31939	0.649153	0.941903
K=5000, O=500, C=0	49201	33909	26949	0.547733	0.794745
K=2000, O=400, C=5	49201	42274	37090	0.753846	0.877371
K=2000, O=400, C=0	49201	42274	30844	0.626898	0.729621
K=2000, O=300, C=5	49201	43739	36456	0.740961	0.8334
K=2000, O=300, C=0	49201	43739	30488	0.619662	0.697044
K=2000, O=500, C=5	49201	40230	36837	0.748704	0.91566
K=2000, O=500, C=0	49201	40230	30714	0.624256	0.76346
Average	**49201**	**40673.3**	**32860.7**	**0.667887**	**0.81028**

c.) Human Mouse File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	49201	22428	17810	0.361985	0.794097
K=3000, O=400, C=0	49201	22428	13647	0.277372	0.60848
K=3000, O=300, C=5	49201	28323	19168	0.389586	0.676764
K=3000, O=300, C=0	49201	28323	14666	0.298083	0.517812
K=3000, O=500, C=5	49201	17501	15646	0.318002	0.894006
K=3000, O=500, C=0	49201	17501	12110	0.246133	0.69196
K=5000, O=400, C=5	49201	8350	7428	0.150973	0.889581
K=5000, O=400, C=0	49201	8350	5672	0.115282	0.679281
K=5000, O=300,C=5	49201	9607	7140	0.145119	0.743208
K=5000, O=300,C=0	49201	9607	5515	0.112091	0.574061
K=5000, O=500, C=5	49201	8131	7510	0.152639	0.923626
K=5000, O=500, C=0	49201	8131	5668	0.115201	0.697085
K=2000, O=400, C=5	49201	24525	19762	0.401659	0.80579
K=2000, O=400, C=0	49201	24525	15192	0.308774	0.61945
K=2000, O=300, C=5	49201	33396	20036	0.407227	0.599952
K=2000, O=300, C=0	49201	33396	15375	0.312494	0.460384
K=2000, O=500, C=5	49201	19378	17436	0.354383	0.899783
K=2000, O=500, C=0	49201	19378	13540	0.275198	0.698731
Average	**49201**	**19071**	**12962.3**	**0.26456**	**0.70967**

9.) For Dateset09

a.) Human Chimp File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	56031	56027	55997	0.999393	0.999465
K=3000, O=400, C=0	56031	56027	55677	0.993682	0.993753
K=3000, O=300, C=5	56031	56027	55065	0.98276	0.98283
K=3000, O=300, C=0	56031	56027	54746	0.977066	0.977136
K=3000, O=500, C=5	56031	56027	56027	0.999929	1
K=3000, O=500, C=0	56031	56027	55707	0.994218	0.994288
K=5000, O=400, C=5	56031	56027	55997	0.999393	0.999465
K=5000, O=400, C=0	56031	56027	55677	0.993682	0.993753
K=5000, O=300,C=5	56031	56027	55065	0.98276	0.98283
K=5000, O=300,C=0	56031	56027	54746	0.977066	0.977136
K=5000, O=500, C=5	56031	56027	56027	0.999929	1
K=5000, O=500, C=0	56031	56027	55707	0.994218	0.994288
K=2000, O=400, C=5	56031	56027	55997	0.999393	0.999465
K=2000, O=400, C=0	56031	56027	55677	0.993682	0.993753
K=2000, O=300, C=5	56031	56027	55065	0.98276	0.98283
K=2000, O=300, C=0	56031	56027	54746	0.977066	0.977136
K=2000, O=500, C=5	56031	56027	56027	0.999929	1
K=2000, O=500, C=0	56031	56027	55707	0.994218	0.994288
Average	**56031**	**56027**	**55536.5**	**0.99117**	**0.991245**

b.) Human Dog File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	56031	42272	36025	0.642948	0.852219
K=3000, O=400, C=0	56031	42272	29964	0.534775	0.708838
K=3000, O=300, C=5	56031	47068	34821	0.62146	0.739802
K=3000, O=300, C=0	56031	47068	28935	0.516411	0.614749
K=3000, O=500, C=5	56031	40947	35612	0.635577	0.86971
K=3000, O=500, C=0	56031	40947	29824	0.532277	0.728356
K=5000, O=400, C=5	56031	34767	29004	0.517642	0.834239
K=5000, O=400, C=0	56031	34767	24231	0.432457	0.696954
K=5000, O=300,C=5	56031	45325	33467	0.597294	0.738378
K=5000, O=300,C=0	56031	45325	27871	0.497421	0.614914
K=5000, O=500, C=5	56031	33708	28673	0.511735	0.850629
K=5000, O=500, C=0	56031	33708	24092	0.429976	0.714726
K=2000, O=400, C=5	56031	43561	37058	0.661384	0.850715
K=2000, O=400, C=0	56031	43561	30876	0.551052	0.708799
K=2000, O=300, C=5	56031	48447	35037	0.625315	0.723203
K=2000, O=300, C=0	56031	48447	29118	0.519677	0.601028
K=2000, O=500, C=5	56031	42220	36638	0.653888	0.867788
K=2000, O=500, C=0	56031	42220	30735	0.548536	0.727973
Average	**56031**	**42035**	**31221.2**	**0.557213**	**0.74683**

c.) Human Mouse File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	56031	17209	13706	0.244615	0.796444
K=3000, O=400, C=0	56031	17209	10787	0.192518	0.626823
K=3000, O=300, C=5	56031	29768	15571	0.2779	0.523079
K=3000, O=300, C=0	56031	29768	12050	0.21506	0.404797
K=3000, O=500, C=5	56031	13761	11404	0.20353	0.828719
K=3000, O=500, C=0	56031	13761	9118	0.162731	0.662597
K=5000, O=400, C=5	56031	5878	4518	0.0806339	0.768629
K=5000, O=400, C=0	56031	5878	3403	0.0607342	0.578938
K=5000, O=300,C=5	56031	10332	4808	0.0858096	0.46535
K=5000, O=300,C=0	56031	10332	3628	0.0647499	0.351142
K=5000, O=500, C=5	56031	2950	2237	0.0399243	0.758305
K=5000, O=500, C=0	56031	2950	1841	0.0328568	0.624068
K=2000, O=400, C=5	56031	29654	22973	0.410005	0.774702
K=2000, O=400, C=0	56031	29654	17886	0.319216	0.603156
K=2000, O=300, C=5	56031	40193	21118	0.376898	0.525415
K=2000, O=300, C=0	56031	40193	16213	0.289358	0.403379
K=2000, O=500, C=5	56031	24802	20243	0.361282	0.816184
K=2000, O=500, C=0	56031	24802	15856	0.282986	0.639303
Average	**56031**	**19394.1**	**11520**	**0.2056**	**0.6195**

10.) For Dateset10

a.) Human Chimp File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	49532	49054	49025	0.989764	0.999409
K=3000, O=400, C=0	49532	49054	48529	0.97975	0.989298
K=3000, O=300, C=5	49532	49528	47855	0.966143	0.966221
K=3000, O=300, C=0	49532	49528	47568	0.960349	0.960426
K=3000, O=500, C=5	49532	49054	49025	0.989764	0.999409
K=3000, O=500, C=0	49532	49054	48529	0.97975	0.989298
K=5000, O=400, C=5	49532	49054	49025	0.989764	0.999409
K=5000, O=400, C=0	49532	49054	48529	0.97975	0.989298
K=5000, O=300,C=5	49532	49528	47855	0.966143	0.966221
K=5000, O=300,C=0	49532	49528	47568	0.960349	0.960426
K=5000, O=500, C=5	49532	49054	49025	0.989764	0.999409
K=5000, O=500, C=0	49532	49054	48529	0.97975	0.989298
K=2000, O=400, C=5	49532	49054	49025	0.989764	0.999409
K=2000, O=400, C=0	49532	49054	48529	0.97975	0.989298
K=2000, O=300, C=5	49532	49528	47855	0.966143	0.966221
K=2000, O=300, C=0	49532	49528	47568	0.960349	0.960426
K=2000, O=500, C=5	49532	49054	49025	0.989764	0.999409
K=2000, O=500, C=0	49532	49054	48529	0.97975	0.989298
Average	**49532**	**49212**	**48421.83**	**0.977587**	**0.98401**

b.) Human Dog File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	49532	44719	40482	0.81729	0.905253
K=3000, O=400, C=0	49532	44719	33710	0.68057	0.753818
K=3000, O=300, C=5	49532	45736	38281	0.772854	0.836999
K=3000, O=300, C=0	49532	45736	32005	0.646148	0.699777
K=3000, O=500, C=5	49532	43538	40873	0.825184	0.938789
K=3000, O=500, C=0	49532	43538	40873	0.825184	0.938789
K=5000, O=400, C=5	49532	43736	38742	0.782161	0.885815
K=5000, O=400, C=0	49532	43736	32261	0.651316	0.73763
K=5000, O=300,C=5	49532	44738	38093	0.769058	0.851469
K=5000, O=300,C=0	49532	44738	31831	0.642635	0.711498
K=5000, O=500, C=5	49532	42567	39108	0.78955	0.91874
K=5000, O=500, C=0	49532	42567	32551	0.657171	0.7647
K=2000, O=400, C=5	49532	44719	40482	0.81729	0.905253
K=2000, O=400, C=0	49532	44719	33710	0.68057	0.753818
K=2000, O=300, C=5	49532	45736	38281	0.772854	0.836999
K=2000, O=300, C=0	49532	45736	32005	0.646148	0.699777
K=2000, O=500, C=5	49532	43538	40873	0.825184	0.938789
K=2000, O=500, C=0	49532	43538	34037	0.687172	0.781777
Average	**49532**	**44336.33**	**36566.56**	**0.738241**	**0.825538**

c.) Human Mouse File:

Parameter / Computation	True Match Count	Computed Match Count	Computed Correct Match	Sensitivity	Specificity
K=3000, O=400, C=5	49532	19617	16376	0.330615	0.834786
K=3000, O=400, C=0	49532	19617	12640	0.255189	0.644339
K=3000, O=300, C=5	49532	25452	16928	0.341759	0.665095
K=3000, O=300, C=0	49532	25452	12634	0.255067	0.496385
K=3000, O=500, C=5	49532	17731	15363	0.310163	0.866449
K=3000, O=500, C=0	49532	17731	11792	0.238068	0.66505
K=5000, O=400, C=5	49532	2927	2486	0.0501898	0.849334
K=5000, O=400, C=0	49532	2927	1936	0.0390858	0.661428
K=5000, O=300,C=5	49532	3004	2505	0.0505734	0.833888
K=5000, O=300,C=0	49532	3004	1923	0.0388234	0.640146
K=5000, O=500, C=5	49532	2809	2374	0.0479286	0.845141
K=5000, O=500, C=0	49532	2809	1872	0.0377937	0.666429
K=2000, O=400, C=5	49532	24537	20088	0.405556	0.818682
K=2000, O=400, C=0	49532	24537	15516	0.313252	0.632351
K=2000, O=300, C=5	49532	33034	19929	0.402346	0.603288
K=2000, O=300, C=0	49532	33034	14959	0.302007	0.452836
K=2000, O=500, C=5	49532	20993	18476	0.373011	0.880103
K=2000, O=500, C=0	49532	20993	14428	0.291286	0.687277
Average	**49532**	**16678.22**	**11234.72**	**0.226817**	**0.707945**

5.) Observation / Summary:

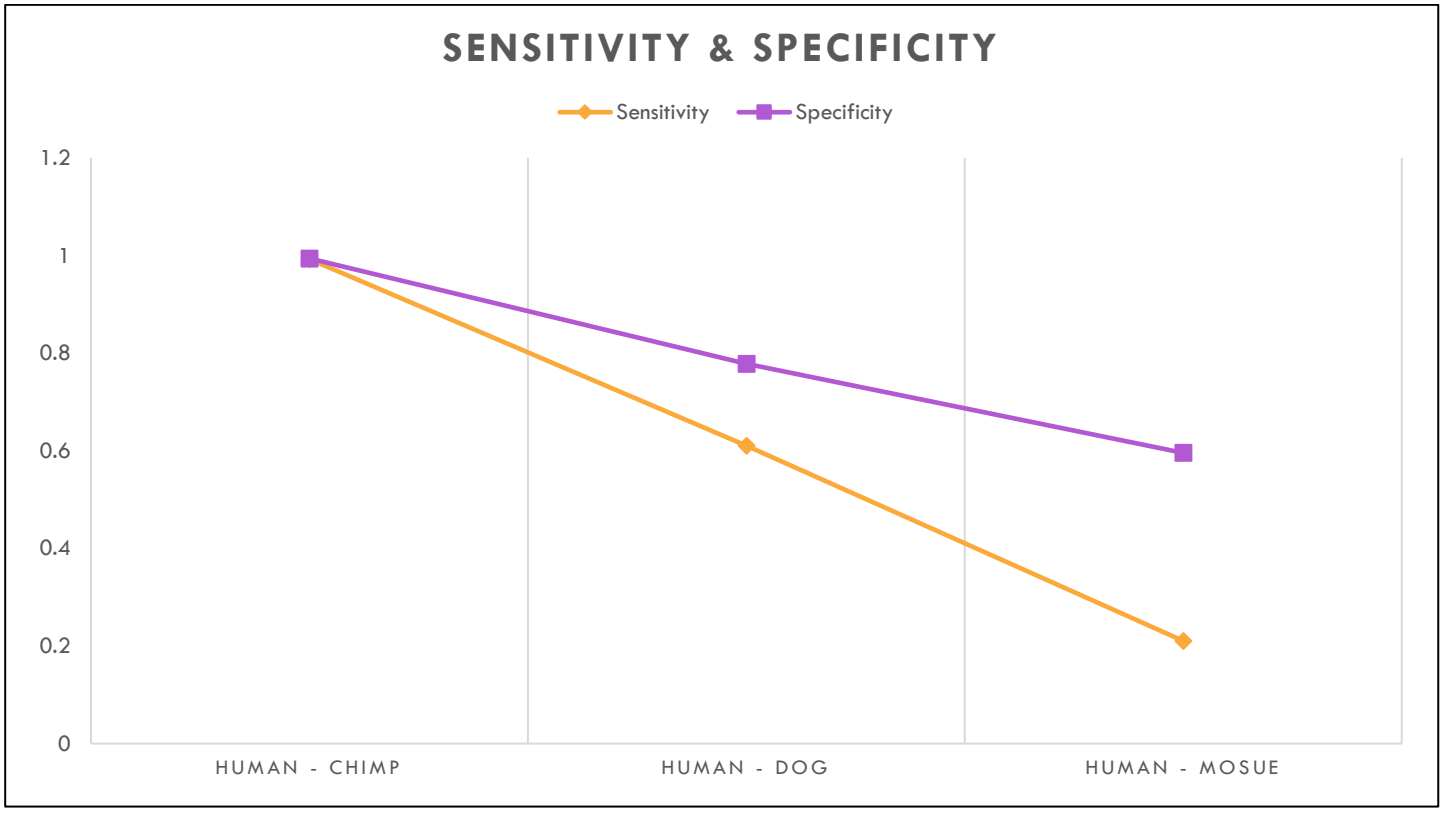
- Across all the datasets we observe that when *'C'* value is assigned to *'5'*, we can see that the **sensitivity and specificity value is more** compared to when the *'C'* is at *'0'*.

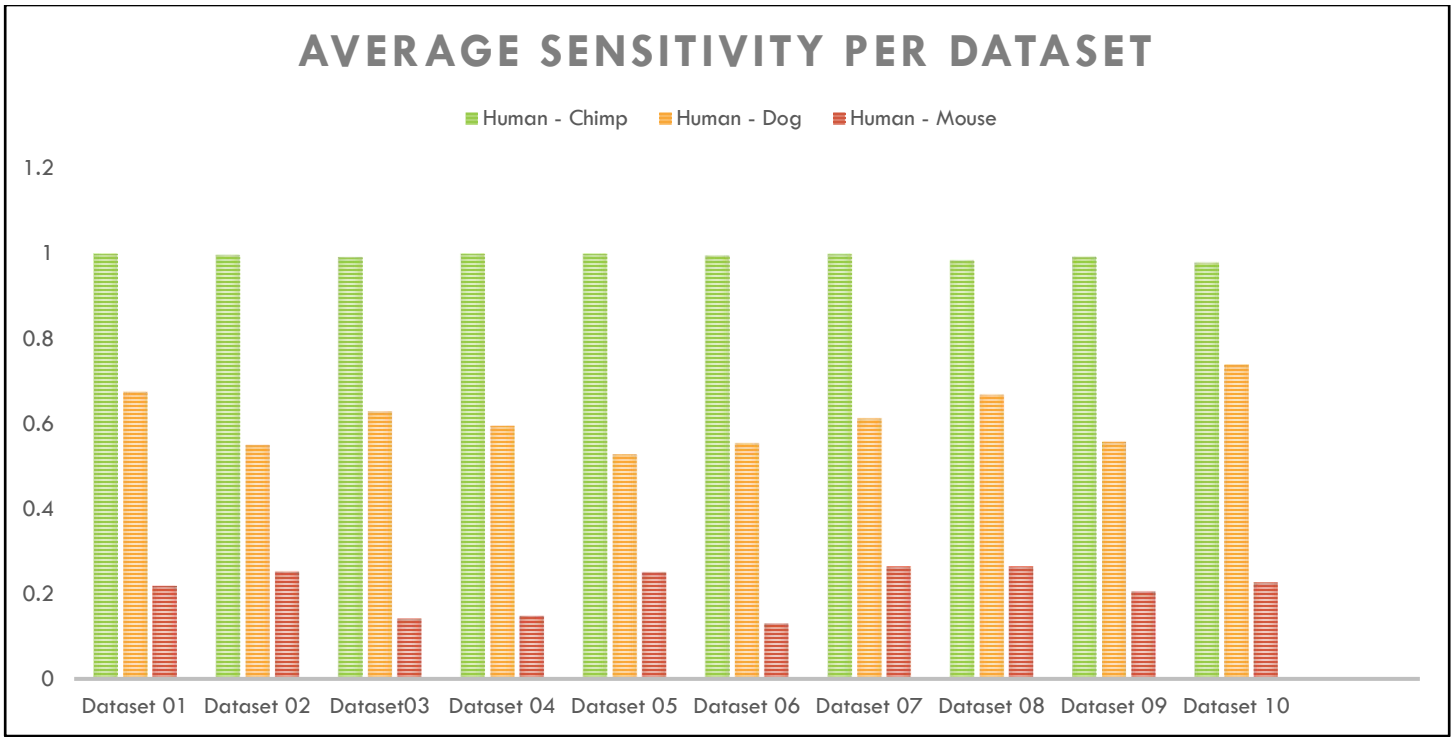
- We notice that comparing all the dataset the ***Human-Chimp*** files have the most sensitivity and specificity value and almost in all the dataset regardless of the *"K = Alignment Score Cut off"*, "*O = Gap Open Penalty*" and "*C*" Parameters the **sensitivity and specificity value is close to 1.**

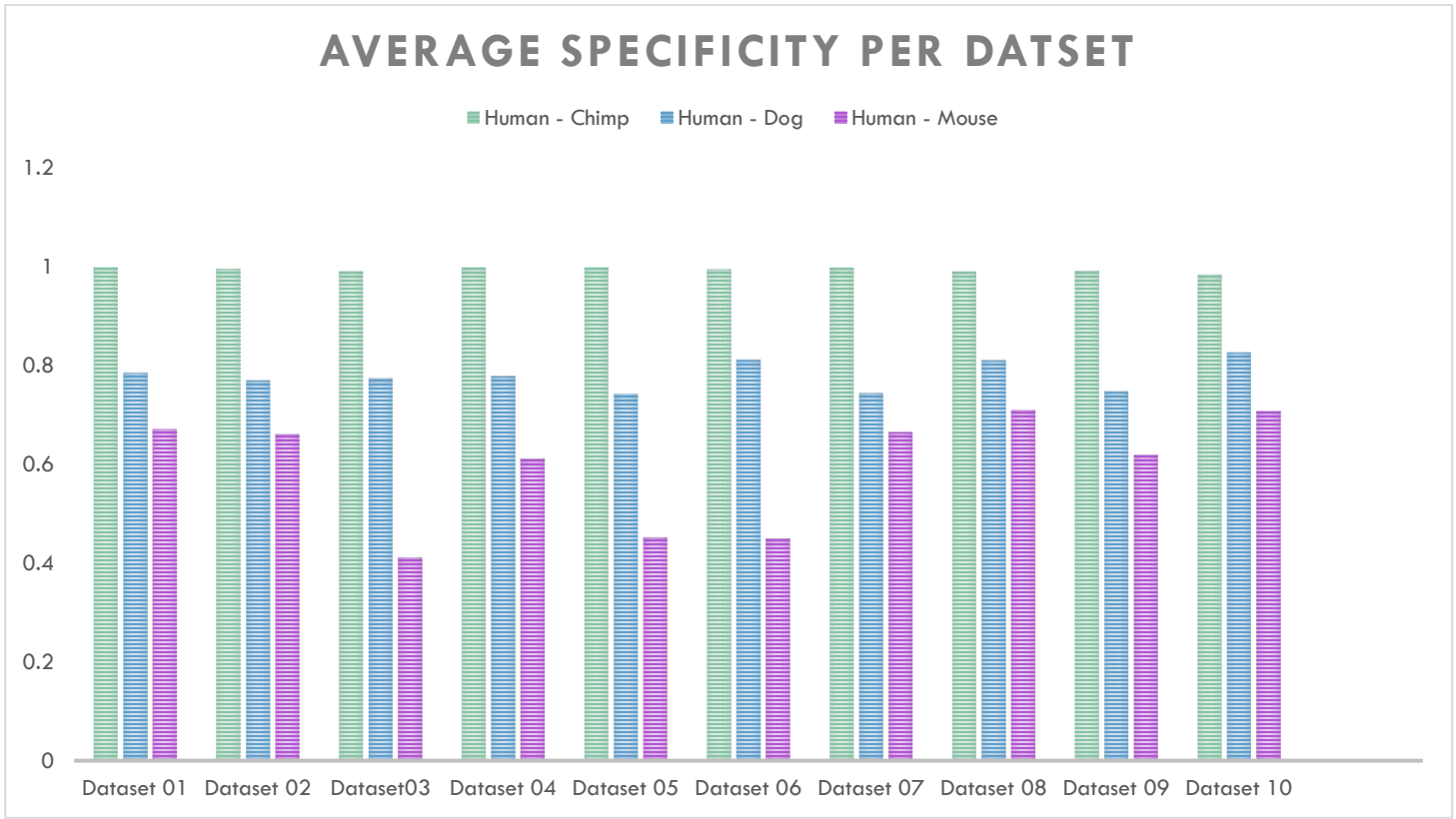
- For Dataset *'3'*, *'5'* and *'6'* when *'K'* i.e. "*Alignment Score Cut off value"* was increased to *'5000'*, I could see that for **Human-Mouse** file the parameters *(Computed Match Count, Computed Correct Match Count, Sensitivity and Specificity)* had the value ***'0'***.

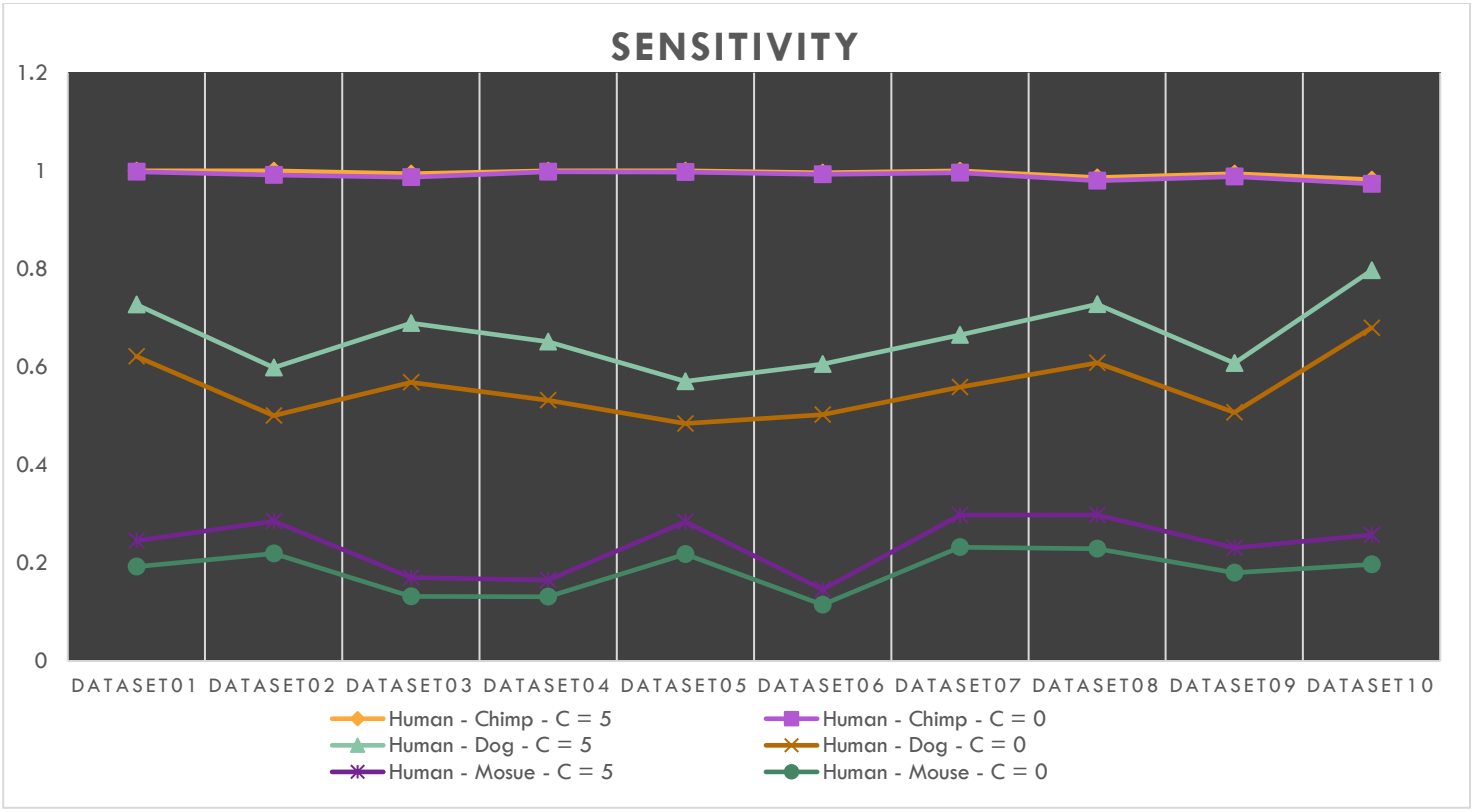
- Across the datasets and all the genome files we can see that when the *'K' i.e. "Alignment Score Cut off Value"* is less the parameters "Computed Match Count, Computed Correct Match Count" increases.

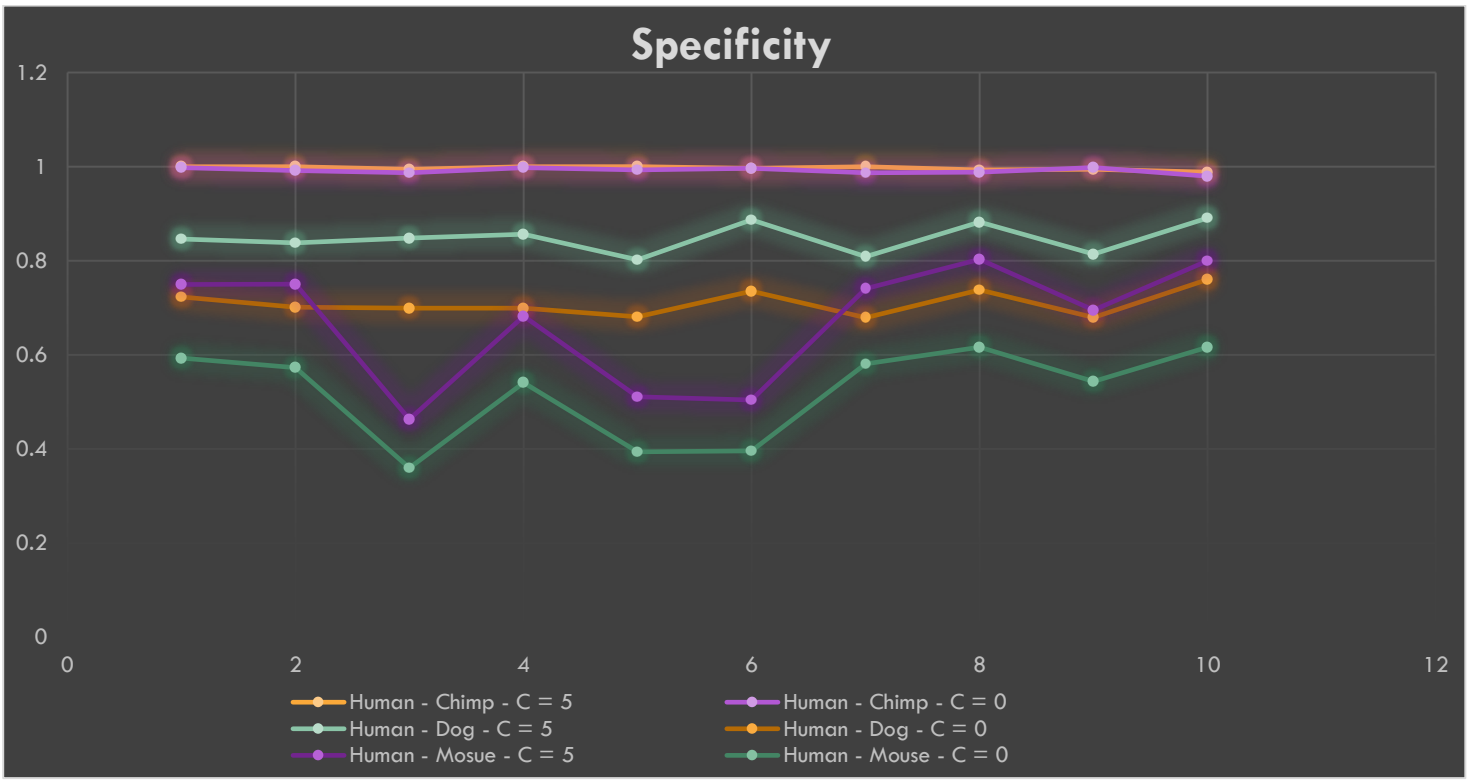
- Across the board we observe that for all the genome files the True match count remains the same throughout for that dataset.

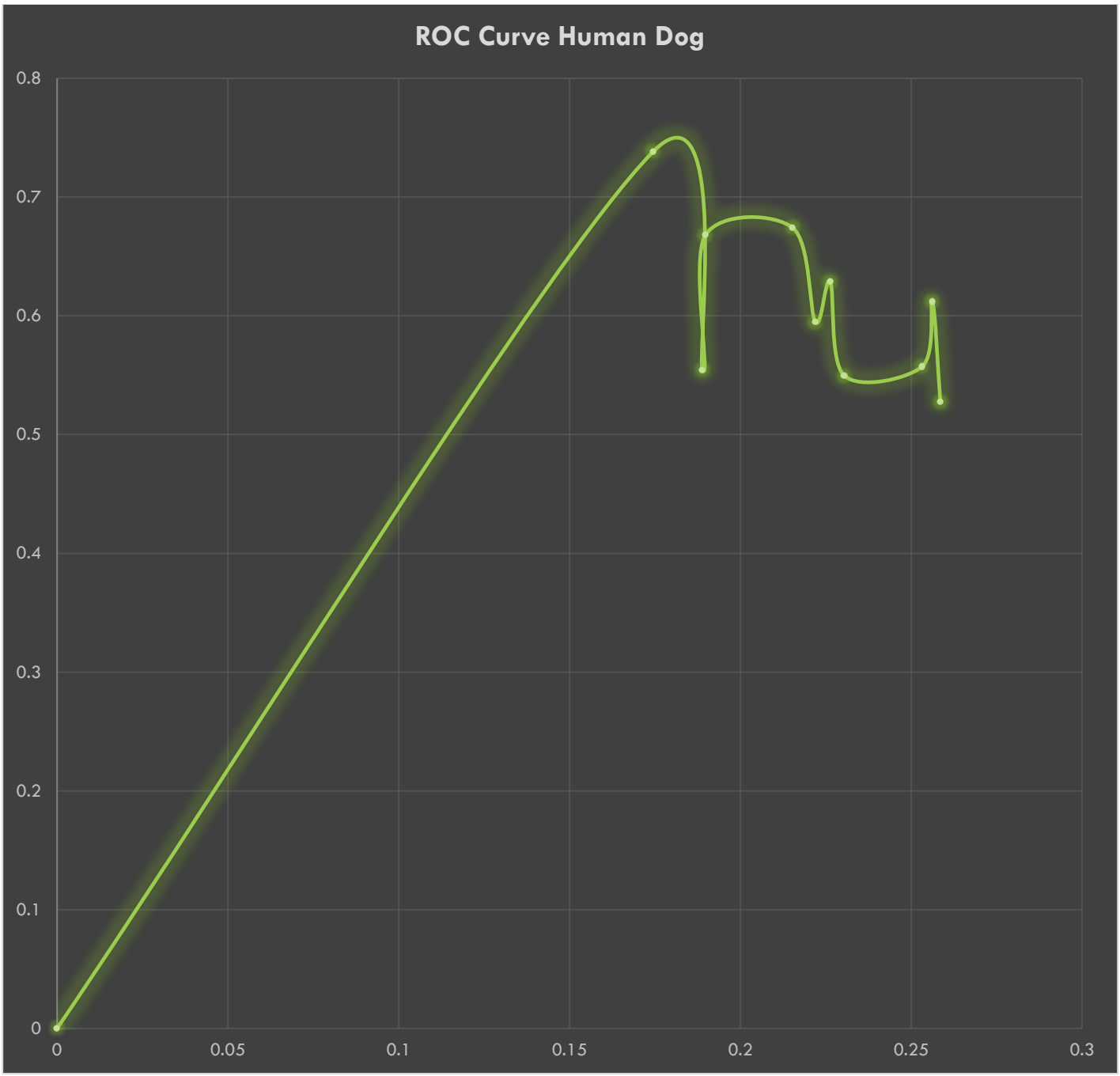


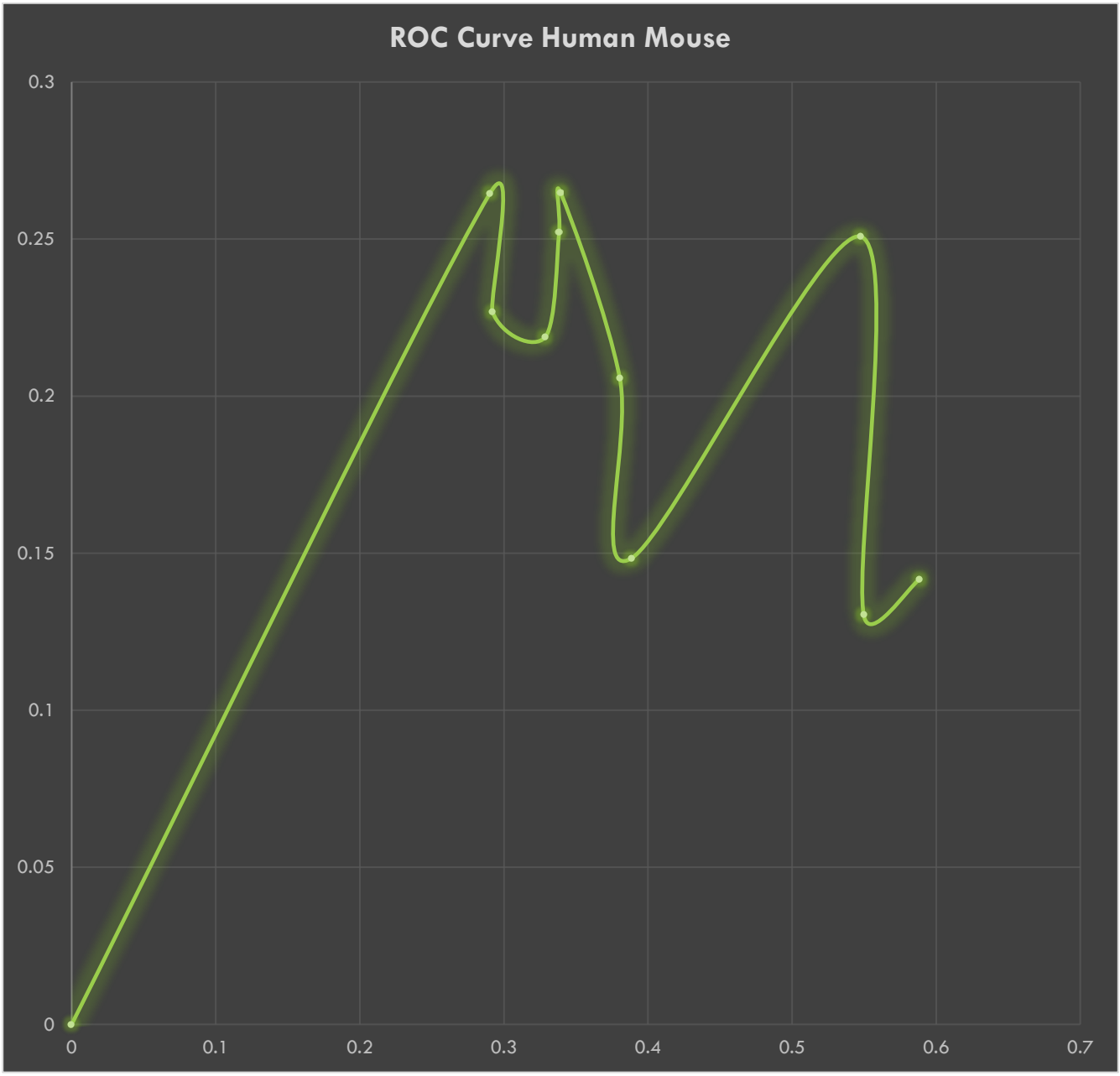

AVERAGE SENSITIVITY PER DATASET
Human - Chimp
Human - Dog
Human - Mouse
1.2
1
0.8
0.6
0.4
0.2
0
Dataset 01
Dataset 02
Dataset03
Dataset 04
Dataset 05
Dataset 06
Dataset 07
Dataset 08
Dataset 09
Dataset 10


AVERAGE SPECIFICITY PER DATSET
Human - Chimp
Human - Dog
Human - Mouse
1.2
1
0.8
0.6
0.4
0.2
0
Dataset 01
Dataset 02
Dataset03
Dataset 04
Dataset 05
Dataset 06
Dataset 07
Dataset 08
Dataset 09
Dataset 10


SENSITIVITY
1.2
1
0.8
0.6
0.4
0.2
0
DATASET01 DATASET02 DATASET03 DATASET04 DATASET05 DATASET06 DATASET07 DATASET08 DATASET09 DATASET10
Human - Chimp - C = 5
Human - Chimp - C = 0
Human - Dog - C = 5
Human - Dog - C = 0
Human - Mosue - C = 5
Human - Mouse - C = 0


Specificity
1.2
1
0.8
0.6
0.4
0.2
0
0
2
4
6
8
10
12
Human - Chimp - C = 5
Human - Chimp - C = 0
Human - Dog - C = 5
Human - Dog - C = 0
Human - Mosue - C = 5
Human - Mouse - C = 0


ROC Curve Human Dog
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.05
0.1
0.15
0.2
0.25
0.3


ROC Curve Human Mouse
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7