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**CSCI 652 Algorithmic Bioinformatics**

**Z-ID: Z1893417**

**Assignment 3**

**Programming Language Used**: Python (3.9.6). I also used the version on the server to view the results (version 3.7.3).

**Time Spent:** I spent about 10 hours completing this assignment. I used about 8 hours to write the code and spent the remaining time writing documentation and the final report for project.

**Dataset 01**

**Human and Chimp (Criteria = 5)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 3000, O = 300** | 52948 | 52944 | 52941 | 0.9999 | 0.9999 |
| **K = 3000, O = 400** | 52948 | 52944 | 52941 | 0.9999 | 0.9999 |
| **K = 3000, O = 500** | 52948 | 52944 | 52941 | 0.9999 | 0.9999 |
| **K = 5000, O = 300** | 52948 | 52944 | 52941 | 0.9999 | 0.9999 |
| **K = 5000, O = 400** | 52948 | 52944 | 52941 | 0.9999 | 0.9999 |
| **K = 5000, O = 500** | 52948 | 52944 | 52941 | 0.9999 | 0.9999 |
| **K = 2000, O = 300** | 52948 | 52944 | 52941 | 0.9999 | 0.9999 |
| **K = 2000, O = 400** | 52948 | 52944 | 52941 | 0.9999 | 0.9999 |
| **K = 2000, O = 500** | 52948 | 52944 | 52941 | 0.9999 | 0.9999 |
| **Average ± SD** |  |  |  | 0.9999 ± 0.0000 | 0.9999 ± 0.0000 |

**Human and Chimp (Criteria = 0)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 3000, O = 300** | 52948 | 52944 | 52888 | 0.9989 | 0.9989 |
| **K = 3000, O = 400** | 52948 | 52944 | 52888 | 0.9989 | 0.9989 |
| **K = 3000, O = 500** | 52948 | 52944 | 52888 | 0.9989 | 0.9989 |
| **K = 5000, O = 300** | 52948 | 52944 | 52888 | 0.9989 | 0.9989 |
| **K = 5000, O = 400** | 52948 | 52944 | 52888 | 0.9989 | 0.9989 |
| **K = 5000, O = 500** | 52948 | 52944 | 52888 | 0.9989 | 0.9989 |
| **K = 2000, O = 300** | 52948 | 52944 | 52888 | 0.9989 | 0.9989 |
| **K = 2000, O = 400** | 52948 | 52944 | 52888 | 0.9989 | 0.9989 |
| **K = 2000, O = 500** | 52948 | 52944 | 52888 | 0.9989 | 0.9989 |
| **Average ± SD** |  |  |  | 0.9989 ± 0.0000 | 0.9989 ± 0.0000 |

**Human and Dog (Criteria = 5)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 3000, O = 300** | 52948 | 50885 | 37800 | 0.7139 | 0.7429 |
| **K = 3000, O = 400** | 52948 | 44253 | 38703 | 0.7310 | 0.8746 |
| **K = 3000, O = 500** | 52948 | 42563 | 39317 | 0.7426 | 0.9237 |
| **K = 5000, O = 300** | 52948 | 50560 | 37800 | 0.7139 | 0.7476 |
| **K = 5000, O = 400** | 52948 | 44156 | 38606 | 0.7291 | 0.8743 |
| **K = 5000, O = 500** | 52948 | 40015 | 36871 | 0.6963 | 0.9214 |
| **K = 2000, O = 300** | 52948 | 52168 | 38365 | 0.7246 | 0.7354 |
| **K = 2000, O = 400** | 52548 | 44942 | 39371 | 0.7436 | 0.8760 |
| **K = 2000, O = 500** | 52948 | 43038 | 39785 | 0.7514 | 0.9244 |
| **Average ± SD** |  |  |  | 0.7274 ± 0.0174 | 0.8467 ± 0.0813 |

**Human and Dog (Criteria = 0)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 3000, O = 300** | 52948 | 50885 | 33736 | 0.6372 | 0.6630 |
| **K = 3000, O = 400** | 52948 | 44253 | 34288 | 0.6476 | 0.7748 |
| **K = 3000, O = 500** | 52948 | 42563 | 34967 | 0.6604 | 0.8215 |
| **K = 5000, O = 300** | 52948 | 50560 | 33736 | 0.6372 | 0.6672 |
| **K = 5000, O = 400** | 52948 | 44156 | 34197 | 0.6459 | 0.7744 |
| **K = 5000, O = 500** | 52948 | 40015 | 32875 | 0.6209 | 0.8216 |
| **K = 2000, O = 300** | 52948 | 52168 | 34077 | 0.6436 | 0.6532 |
| **K = 2000, O = 400** | 52548 | 44942 | 34744 | 0.6562 | 0.7731 |
| **K = 2000, O = 500** | 52948 | 43038 | 35411 | 0.6688 | 0.8228 |
| **Average ± SD** |  |  |  | 0.6464 ± 0.0142 | 0.7524 ± 0.0716 |

**Human and Mouse (Criteria = 5)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 52948 | 36484 | 22463 | 0.4242 | 0.6157 |
| **K = 2000, O = 400** | 52848 | 28563 | 22920 | 0.4329 | 0.8024 |
| **K = 2000, O = 500** | 52948 | 23704 | 20582 | 0.3887 | 0.8683 |
| **K = 3000, O = 300** | 52948 | 27327 | 17150 | 0.3239 | 0.6276 |
| **K = 3000, O = 400** | 52948 | 19277 | 15336 | 0.2896 | 0.7956 |
| **K = 3000, O = 500** | 52948 | 13787 | 1300 | 0.2323 | 0.8921 |
| **K = 5000, O = 300** | 52948 | 5554 | 2071 | 0.0391 | 0.3729 |
| **K = 5000, O = 400** | 52948 | 2268 | 1995 | 0.0377 | 0.8796 |
| **K = 5000, O = 500** | 52948 | 2268 | 2016 | 0.0381 | 0.8889 |
| **Average ± SD** |  |  |  | 0.2452 ± 0.1676 | 0.7492 ± 0.1769 |

**Human and Mouse (Criteria = 0)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 52984 | 36484 | 17603 | 0.3324 | 0.4825 |
| **K = 2000, O = 400** | 52984 | 28563 | 18591 | 0.3511 | 0.6509 |
| **K = 2000, O = 500** | 52948 | 23704 | 16553 | 0.3126 | 0.6983 |
| **K = 3000, O = 300** | 52948 | 27327 | 13572 | 0.2563 | 0.4967 |
| **K = 3000, O = 400** | 52948 | 19277 | 12505 | 0.2362 | 0.6487 |
| **K = 3000, O = 500** | 52948 | 13787 | 9952 | 0.1880 | 0.7218 |
| **K = 5000, O = 300** | 52948 | 5554 | 1706 | 0.0322 | 0.3072 |
| **K = 5000, O = 400** | 52948 | 2268 | 1617 | 0.0305 | 0.7130 |
| **K = 5000, O = 500** | 52948 | 2268 | 1641 | 0.0310 | 0.7235 |
| **Average ± SD** |  |  |  | 0.1967 ± 0.1337 | 0.6047 ± 0.1447 |

**Dataset 02**

**Human and Chimp (Criteria = 5**)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 58012 | 58006 | 54792 | 0.9445 | 0.9445 |
| **K = 2000, O = 400** | 58012 | 58006 | 58004 | 0.9999 | 1.0000 |
| **K = 2000, O = 500** | 58012 | 58006 | 58004 | 0.9999 | 1. 0000 |
| **K = 3000, O = 300** | 58012 | 58006 | 54792 | 0.9445 | 0.9446 |
| **K = 3000, O = 400** | 58012 | 58006 | 58004 | 0.999 | 1.000 |
| **K = 3000, O = 500** | 58012 | 58006 | 0.58004 | 0.9999 | 1.000 |
| **K = 5000, O = 300** | 58012 | 58006 | 54792 | 0.9445 | 0.9446 |
| **K = 5000, O = 400** | 58012 | 58006 | 58004 | 0.9999 | 1.000 |
| **K = 5000, O = 500** | 58012 | 58006 | 58004 | 0.9999 | 1.000 |
| **Average ± SD** |  |  |  | 0.9813 ± 0.0276 | 0.9792 ± 0.0287 |

**Human and Chimp (Criteria = 0)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 58012 | 58006 | 54776 | 0.9442 | 0.9443 |
| **K = 2000, O = 400** | 58012 | 58006 | 57986 | 0.9999 | 0.9997 |
| **K = 2000, O = 500** | 58012 | 58006 | 57986 | 0.9996 | 0.9997 |
| **K = 3000, O = 300** | 58012 | 58006 | 54776 | 0.9442 | 0.9443 |
| **K = 3000, O = 400** | 58012 | 58006 | 57986 | 0.9996 | 0.9997 |
| **K = 3000, O = 500** | 58012 | 58006 | 57986 | 0.9996 | 0.9997 |
| **K = 5000, O = 300** | 58012 | 58006 | 54776 | 0.9442 | 0.9443 |
| **K = 5000, O = 400** | 58012 | 58006 | 57986 | 0.9996 | 0.9997 |
| **K = 5000, O = 500** | 58012 | 58006 | 57986 | 0.9996 | 0.9997 |
| **Average ± SD** |  |  |  | 0.9812 ± 0.0277 | 0.9812 ± 0.0277 |

**Human and Dog (Criteria = 5)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 58012 | 49090 | 35950 | 0.6197 | 0.7323 |
| **K = 2000, O = 400** | 58012 | 42761 | 38264 | 0.6596 | 0.8948 |
| **K = 2000, O = 500** | 58012 | 41640 | 38055 | 0.6560 | 0.9139 |
| **K = 3000, O = 300** | 58012 | 49090 | 35951 | 0.6197 | 0.7323 |
| **K = 3000, O = 400** | 58012 | 42761 | 38265 | 0.6596 | 0.8949 |
| **K = 3000, O = 500** | 58012 | 41525 | 37941 | 0.6540 | 0.9137 |
| **K = 5000, O = 300** | 58012 | 43091 | 30447 | 0.5248 | 0.7066 |
| **K = 5000, O = 400** | 58012 | 34730 | 31055 | 0.5353 | 0.8942 |
| **K = 5000, O = 500** | 58012 | 31373 | 28448 | 0.4904 | 0.9068 |
| **Average ± SD** |  |  |  | 0.6021 ± 0.0668 | 0.8433 ± 0.0903 |

**Human and Dog (Criteria = 0)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 58012 | 49090 | 31418 | 0.5416 | 0.6400 |
| **K = 2000, O = 400** | 58012 | 42761 | 33815 | 0.5829 | 0.7908 |
| **K = 2000, O = 500** | 58012 | 41640 | 33543 | 0.5782 | 0.8055 |
| **K = 3000, O = 300** | 58012 | 49090 | 31372 | 0.5408 | 0.6391 |
| **K = 3000, O = 400** | 58012 | 42761 | 33777 | 0.5822 | 0.7899 |
| **K = 3000, O = 500** | 58012 | 41525 | 33387 | 0.5755 | 0.8040 |
| **K = 5000, O = 300** | 58012 | 43091 | 26389 | 0.4549 | 0.6124 |
| **K = 5000, O = 400** | 58012 | 34730 | 27263 | 0.4700 | 0.7850 |
| **K = 5000, O = 500** | 58012 | 31373 | 24889 | 0.4290 | 0.7933 |
| **Average ± SD** |  |  |  | 0.5283 ± 0.0608 | 0.7400 ± 0.0828 |

**Human and Mouse (Criteria = 5)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 58012 | 35607 | 20739 | 0.3575 | 0.5824 |
| **K = 2000, O = 400** | 58012 | 29870 | 22793 | 0.3929 | 0.7631 |
| **K = 2000, O = 500** | 58012 | 26594 | 22053 | 0.3801 | 0.8292 |
| **K = 3000, O = 300** | 58012 | 30966 | 19337 | 0.333 | 0.6245 |
| **K = 3000, O = 400** | 58012 | 22247 | 17143 | 0.2955 | 0.7706 |
| **K = 3000, O = 500** | 58012 | 20395 | 16356 | 0.2819 | 0.8020 |
| **K = 5000, O = 300** | 58012 | 19611 | 12111 | 0.2088 | 0.6507 |
| **K = 5000, O = 400** | 58012 | 12840 | 10676 | 0.18403 | 0.8315 |
| **K = 5000, O = 500** | 58012 | 8568 | 7684 | 0.1325 | 0.8968 |
| **Average ± SD** |  |  |  | 0.2853 ± 0.0919 | 0.7501 ± 0.8968 |

**Human and Mouse (Criteria = 0)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 58012 | 35607 | 16492 | 0.2843 | 0.4631 |
| **K = 2000, O = 400** | 58012 | 29870 | 17915 | 0.3088 | 0.5997 |
| **K = 2000, O = 500** | 58012 | 26594 | 17619 | 0.3037 | 0.6625 |
| **K = 3000, O = 300** | 58012 | 30966 | 15305 | 0.2638 | 0.4942 |
| **K = 3000, O = 400** | 58012 | 22247 | 13382 | 0.2306 | 0.6015 |
| **K = 3000, O = 500** | 58012 | 20395 | 13157 | 0.2268 | 0.6451 |
| **K = 5000, O = 300** | 58012 | 18611 | 9437 | 0.1627 | 0.5071 |
| **K = 5000, O = 400** | 58012 | 12840 | 8167 | 0.1408 | 0.6361 |
| **K = 5000, O = 500** | 58012 | 8568 | 6186 | 0.1066 | 0.7220 |
| **Average ± SD** |  |  |  | 0.2253 ± 0.0735 | 0.5924 ± 0.0867 |

**Dataset 3**

**Human and Chimp (Criteria = 5)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 57116 | 57112 | 56121 | 0.9826 | 0.9826 |
| **K = 2000, O = 400** | 57116 | 57112 | 57106 | 0.9998 | 0.9999 |
| **K = 2000, O = 500** | 57116 | 57112 | 57106 | 0.9998 | 0.9999 |
| **K = 3000, O = 300** | 57116 | 57112 | 56121 | 0.9826 | 0.9826 |
| **K = 3000, O = 400** | 57116 | 57112 | 57106 | 0.9999 | 0.9999 |
| **K = 3000, O = 500** | 57116 | 57112 | 57106 | 0.9998 | 0.9999 |
| **K = 5000, O = 300** | 57116 | 57112 | 56121 | 0.9826 | 0.9826 |
| **K = 5000, O = 400** | 57116 | 57112 | 57106 | 0.9998 | 0.9999 |
| **K = 5000, O = 500** | 57116 | 57112 | 57106 | 0.9998 | 0.9999 |
| **Average ± SD** |  |  |  | 0.9941 ± 0.0086 | 0.9941 ± 0.0087 |

**Human and Chimp (Criteria = 0)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 57116 | 57112 | 56070 | 0.9817 | 0.9818 |
| **K = 2000, O = 400** | 57116 | 57112 | 56954 | 0.9972 | 0.9972 |
| **K = 2000, O = 500** | 57116 | 57112 | 56954 | 0.9972 | 0.9972 |
| **K = 3000, O = 300** | 57116 | 57112 | 56070 | 0.9817 | 0.9818 |
| **K = 3000, O = 400** | 57116 | 57112 | 56954 | 0.9972 | 0.9972 |
| **K = 3000, O = 500** | 57116 | 57112 | 56954 | 0.9972 | 0.9972 |
| **K = 5000, O = 300** | 57116 | 57112 | 56070 | 0.9817 | 0.9818 |
| **K = 5000, O = 400** | 57116 | 57112 | 56954 | 0.9972 | 0.9972 |
| **K = 5000, O = 500** | 57116 | 57112 | 56954 | 0.9972 | 0.9972 |
| **Average ± SD** |  |  |  | 0.9920 ± 0.0078 | 0.9921 ± 0.0077 |

**Human and Dog (Criteria = 5)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 57116 | 51333 | 40399 | 0.7073 | 0.7870 |
| **K = 2000, O = 400** | 57116 | 48222 | 42063 | 0.7364 | 0.8723 |
| **K = 2000, O = 500** | 57116 | 47631 | 42101 | 0.7371 | 0.8839 |
| **K = 3000, O = 300** | 57116 | 49711 | 39611 | 0.6935 | 0.7968 |
| **K = 3000, O = 400** | 57116 | 47318 | 41362 | 0.7242 | 0.8741 |
| **K = 3000, O = 500** | 57116 | 46727 | 41409 | 0.7250 | 0.8862 |
| **K = 5000, O = 300** | 57116 | 47128 | 37118 | 0.6499 | 0.7876 |
| **K = 5000, O = 400** | 57116 | 40551 | 35189 | 0.6161 | 0.8677 |
| **K = 5000, O = 500** | 57116 | 39960 | 35223 | 0.6167 | 0.8815 |
| **Average ± SD** |  |  |  | 0.6896 ± 0.0494 | 0.8486 ± 0.0440 |

**Human and Dog (Criteria = 0)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 57116 | 51333 | 35243 | 0.6170 | 0.6866 |
| **K = 2000, O = 400** | 57116 | 48222 | 36765 | 0.6437 | 0.7624 |
| **K = 2000, O = 500** | 57116 | 47631 | 36807 | 0.6444 | 0.7728 |
| **K = 3000, O = 300** | 57116 | 49711 | 34470 | 0.6035 | 0.6934 |
| **K = 3000, O = 400** | 57116 | 47318 | 36116 | 0.6323 | 0.7633 |
| **K = 3000, O = 500** | 57116 | 46727 | 36346 | 0.6364 | 0.7778 |
| **K = 5000, O = 300** | 57116 | 47128 | 32209 | 0.5639 | 0.6834 |
| **K = 5000, O = 400** | 57116 | 40551 | 30667 | 0.5369 | 0.7563 |
| **K = 5000, O = 500** | 57116 | 39960 | 30749 | 0.5384 | 0.7694 |
| **Average ± SD** |  |  |  | 0.6018 ± 0.0442 | 0.7406 ± 0.0402 |

**Human and Mouse (Criteria = 5)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 57116 | 29831 | 17718 | 0.3102 | 0.5939 |
| **K = 2000, O = 400** | 57116 | 25699 | 18672 | 0.3269 | 0.7266 |
| **K = 2000, O = 500** | 57116 | 20660 | 16857 | 0.2951 | 0.8159 |
| **K = 3000, O = 300** | 57116 | 26488 | 15302 | 0.2679 | 0.5777 |
| **K = 3000, O = 400** | 57116 | 17110 | 12085 | 0.2116 | 0.7063 |
| **K = 3000, O = 500** | 57116 | 11343 | 8657 | 0.1516 | 0.7632 |
| **K = 5000, O = 300** | 57116 | 0 | 0 | 0.0000 | 0.0000 |
| **K = 5000, O = 400** | 57116 | 0 | 0 | 0.0000 | 0.0000 |
| **K = 5000, O = 500** | 57116 | 0 | 0 | 0.0000 | 0.0000 |
| **Average ± SD** |  |  |  | 0.1737 ± 0.1406 | 0.4648 ± 0.3565 |

**Human and Mouse (Criteria = 0)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameters** | **True Count** | **Computed Count** | **Correct** | **Sensitivity** | **Specificity** |
| **K = 2000, O = 300** | 57116 | 29831 | 13627 | 0.2386 | 0.4569 |
| **K = 2000, O = 400** | 57116 | 25699 | 14780 | 0.2588 | 0.5751 |
| **K = 2000, O = 500** | 57116 | 20660 | 13619 | 0.2384 | 0.6592 |
| **K = 3000, O = 300** | 57116 | 26488 | 11822 | 0.2070 | 0.4463 |
| **K = 3000, O = 400** | 57116 | 17110 | 9835 | 0.1722 | 0.5748 |
| **K = 3000, O = 500** | 57116 | 11343 | 7165 | 0.1254 | 0.6317 |
| **K = 5000, O = 300** | 57116 | 0 | 0 | 0.0000 | 0.0000 |
| **K = 5000, O = 400** | 57116 | 0 | 0 | 0.0000 | 0.0000 |
| **K = 5000, O = 500** | 57116 | 0 | 0 | 0.0000 | 0.0000 |
| **Average ± SD** |  |  |  | 0.1378 ± 0.1107 | 0.3716 ± 0.2873 |

Fig 2: A bar chart showing sensitivity values between human and other species in three different datasets

Fig 1: A bar chart showing sensitivity values between human and other species in three different datasets

**Discussion:**

The above results show that an increase in the “c” value generally leads to an increase in sensitivity and specificity metrics. A “c” value of 5 generally produced a higher specificity and sensitivity value than a “c” value of “0”. This is because an increase in the “c” value allows for the tolerance of more errors during alignment which increases the number of aligned sequences leading to an increase in sensitivity and specificity. The results also show that the value of “K” also affects the sensitivity. Since “K” corresponds to the alignment score cut off, a lower “K” value lowers the threshold for a true alignment which in turn would lead to an increase in the computed count and sensitivity. A greater “K” value indicates a greater threshold for true alignments which leads to a lower sensitivity score. For comparisons between human, dog and mice genomes, an increase in the gap penalty “O”, usually led to a decrease in computed count. This is because increasing the gap penalty leads to fewer alignment reaching the threshold score. The human and chimp genome comparison maintained a high sensitivity and specificity score regardless of the values for “K”, “O” and “C”. This is most likely because of the high similarity between human and chimpanzee genomes allowing for an easier alignment. In general, sensitivity and specificity between human and chimpanzee were higher than those between human-mouse and human-dog. This might indicate a closer genetic similarity between humans and chimpanzee in comparison to humans and dogs/mice.