Submitted by:

Team 35

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AI Term Project

Connect 4 AI vs Human Game Report

Submitted to:

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| **Comparative Analysis of Connect 4 Ai vs Human Game** | | | | | |
| Game Level | Iteration Count | No of Nodes Explored | No of Nodes Explored in respective Iteration | No of Nodes Pruned | No of Nodes Pruned in respective Iteration |
| Easy | 1 | 33 | 33 | 4 | 4 |
| 2 | 80 | 47 | 7 | 3 |
| 3 | 125 | 45 | 11 | 4 |
| 4 | 167 | 42 | 15 | 4 |
| 5 | 214 | 47 | 17 | 2 |
| 6 | 253 | 39 | 21 | 4 |
| 7 | 292 | 39 | 24 | 3 |
| 8 | 323 | 31 | 28 | 4 |
|  | | | | | |
| Medium | 1 | 158 | 158 | 16 | 16 |
| 2 | 354 | 196 | 32 | 16 |
| 3 | 541 | 187 | 53 | 21 |
| 4 | 785 | 244 | 73 | 20 |
| 5 | 981 | 196 | 88 | 15 |
| 6 | 1189 | 208 | 114 | 26 |
| 7 | 1412 | 223 | 138 | 24 |
| 8 | 1662 | 250 | 165 | 27 |
| 9 | 1738 | 76 | 184 | 19 |
| 10 | 1837 | 99 | 201 | 17 |
| 11 | 1933 | 96 | 217 | 16 |
| 12 | 1945 | 12 | 223 | 6 |
|  | | | | | |
| Difficult | 1 | 669 | 669 | 129 | 129 |
| 2 | 1587 | 918 | 257 | 128 |
| 3 | 2417 | 830 | 384 | 127 |
| 4 | 3128 | 711 | 500 | 116 |
| 5 | 4020 | 892 | 629 | 129 |
| 6 | 4361 | 341 | 710 | 81 |
| 7 | 4542 | 181 | 768 | 58 |
| 8 | 4924 | 382 | 850 | 82 |
| 9 | 5256 | 332 | 947 | 97 |
| 10 | 5669 | 413 | 1045 | 98 |
| 11 | 5926 | 257 | 1117 | 72 |
| 12 | 6167 | 241 | 1177 | 60 |
| 13 | 6199 | 32 | 1185 | 8 |
| 14 | 6200 | 1 | 1186 | 1 |
|  | | | | | |
| Challenging | 1 | 13390 | 13390 | 2678 | 2678 |
| 2 | 27268 | 13878 | 5314 | 2636 |
| 3 | 44592 | 17324 | 9195 | 3881 |
| 4 | 54224 | 9632 | 11217 | 2022 |
| 5 | 67992 | 13768 | 13831 | 2614 |
| 6 | 77612 | 9620 | 15775 | 1944 |
| 7 | 84322 | 6710 | 17215 | 1440 |
| 8 | 94673 | 10351 | 19400 | 2185 |
| 9 | 106271 | 11598 | 22021 | 2621 |
| 10 | 123102 | 16831 | 25506 | 3485 |
| 11 | 128024 | 4922 | 26574 | 1068 |
| 12 | 131387 | 3363 | 27326 | 752 |
| 13 | 132160 | 773 | 27568 | 242 |
| 14 | 133203 | 1043 | 27899 | 331 |
|  | | | | | |
| Unbeatable | 1 | 65405 | 65405 | 11768 | 11768 |
| 2 | 156176 | 90771 | 27448 | 15680 |
| 3 | 227386 | 71210 | 39645 | 12197 |
| 4 | 277375 | 49989 | 48203 | 8558 |
| 5 | 298888 | 21513 | 51716 | 3513 |
| 6 | 333500 | 34612 | 59027 | 7311 |
| 7 | 377364 | 43864 | 68118 | 9091 |
| 8 | 402655 | 25291 | 73652 | 5534 |
| 9 | 403501 | 846 | 73980 | 328 |
| 10 | 406278 | 2777 | 74501 | 521 |

**Below are comparative analysis graphs:**

**CONCLUSIONS:**

1) Number of nodes explored is directly proportional to depth of search algorithm. The deeper the search, tougher is the game against AI and larger the number of nodes explored.

2) Number of nodes explored, and number of nodes pruned in a specific iteration depends upon human gameplay. If humans allow AI to easily win the game, this number would be less since AI easily finds a location to drop its piece without much exploration. However, if humans give tough competition to AI these number would be higher as AI would have to explore better options for winning.

**GitHub Link:**

<https://github.com/ayushijar/Connect4-AI-final-project>