

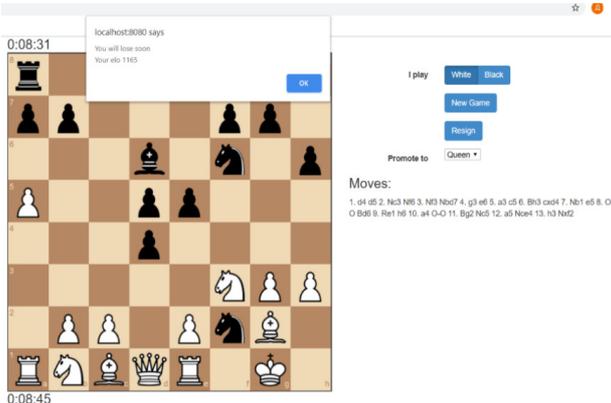
## DEVELOPMENT OF A SINGLE PAGE APPLICATION FOR CALCULATING THE RATING OF CHESS PLAYERS USING A NEURAL NETWORK

Denys Potapenko<sup>1</sup>  
Supervisor: Tetiana TERESHCHENKO<sup>2</sup>

<sup>1</sup> Odessa State Environmental University, Computer Science, Management and Administration Faculty, Computer Science, email: denpotap2000@gmail.com

<sup>2</sup> Engineering Science Ph.D., Odessa State Environmental University, associate professor at the department of information technology, tereshchenko.odessa@gmail.com

The article describes the development of an artificial neural network and a web application that allows you to calculate the rating of a chess player after a minimum number of computer games. Three parameters are used: the total value of the discrepancy between the quality of the player's moves and the moves calculated by the engine, the final position score and the number of moves. Stockfish chess engine, JavaScript technology Node.js, Express.js were used.



Graphical user interface

Artificial neural networks (ANNs) are used in various fields of science, including information technology. They serve as a tool for modeling, processing and classification of large and complex data. ANNs allow you to solve complex problems in cases where conventional mathematical algorithms are ineffective, such as games and learning applications. Chess is not only a sport, but also an interesting and popular game. Therefore, the gaming industry is constantly improving software products and applications for playing chess. When creating such applications, the urgent task is to calculate the ELO rating of chess players, which characterizes the individual strength factor of the player.

Similar applications and programs are used to calibrate new players in the electronic system. After all, now new users are either given a numerical value of the rating, or offered to choose the experience of playing chess from a list that can spoil the fun of the first few games. Or to determine your own rating in terms of the minimum number of games played. There are similar systems in free access, but they have significant drawbacks.

The purpose of the development is to create a software product for calculating the ELO rating of chess players, which uses effective advanced algorithms and has a web interface.

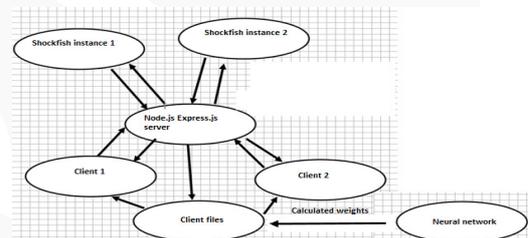
No learning step	Network error	The ratio of the best moves with the moves of the player	Coefficient of advantage	The ratio of the number of moves
1	0.315329	0.39683	0.196941	0.496094
5	0.31152	0.384193	0.184796	0.480563
50	0.243783	0.249732	0.0637954	0.32163
100	0.146432	0.133539	-0.0115329	0.204331
1000	0.0530457	0.000247121	0.0861072	0.044769
5000	0.0498812	0.0108071	0.119492	0.00737206
10000	0.049873	0.0108362	0.119587	0.00726729
18000	0.049873	0.0108362	0.119587	0.00726722
18251	0.049873	0.0108362	0.119587	0.00726722

Network learning results

The project consists of a neural network, client and server parts, installed modules: Express and Stockfish. The entire client part is in one separate directory. Its contents are sent by a server that can be located remotely. There are files in .html, .css, .js format.

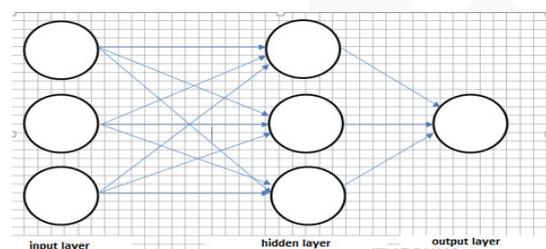
The graphical user interface includes:

- board with figures;
- two chess timers for each player with a set time of 10 minutes;
- two toggle buttons to select a color for the game;
- button to start a new game, a button for the player to admit his defeat;
- a list that opens with the names of the figures into which you can turn a pawn;
- list of moves made in PGN format, dialog box with a message about the player's rating.



Block diagram of the project

As a result, we got a web application that uses an artificial neural network to calculate a chess player's rating after just one game with a computer. Further research is related to the improvement of the project. Additional research is needed to determine the factors that affect the quality of a chess player's game and to determine the weights of these factors. Use a faster and more accurate engine or neural network, such as the AlphaZero neural network, to estimate the position. Optimize neural network code and SPA and update user interface for best user experience. Expand the range of platforms on which the application will be available.



Perceptron