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Artificial Intelligence

24 October 2018

Abstract/Proposal

Title: Dominosa: An Interactive Game and Problem Solver in Python

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Abstract:

In this project, we will be examining the results of various implementations of algorithms and heuristics in the constraint- satisfaction problem, Dominosa, also known as Domino Solitaire. Dominosa is a domino grid logic puzzle that involves a square grid of varying sizes that contains several numbers that each correspond to an unique domino piece. The goal of the puzzle is to place the corresponding domino pieces on their respective places on the grid without having two of the same domino pieces on the grid. This problem was one of the problems on a Tatum’s puzzle website provided earlier within the Artificial Intelligence course. Like many other constraint -satisfaction problems, Dominosa holds real -world significance due to the implementations that it has within not only Computer based fields but also within other fields. These applications involve nurse scheduling, timetabling, and the configuration of computer systems.

For this project, we plan to apply not only the Backtracking Search algorithm, but also the Forward Checking algorithm in order to compare the resulting amount of moves to discover which is more efficient regarding the grid and problem size. We will also use several Constraint-Satisfaction related heuristics, such as minimum remaining value, least-constraining-value, and conflict-directed back jumping in order to continue to increase the overall efficiency for this problem solver. We will also implement different difficulties by allowing the user to input the grid size for the puzzle. Along with this, we hope to also create playable version of this puzzle that can interact with the varying difficulties to compare the moves and efficiency of the AI to a human player. This will hopefully result in the AI finding and producing more efficient solutions than the human player.

Annotated Bibliography

Aggoun, Abderrahmane. “Panorama of Real - Life Applications in Logistics Embedding Bin Packing Optimization Algorithms, Robotics and Cloud Computing Technologies.” *HAL Archives*, 30 Nov. 2016, <https://hal.archives-ouvertes.fr/hal-01378469>.

This source not only explains real world applications of the constraint programming but also offers several algorithms used within constraint programming in order to unpack how constraint programming can be used.

Brailsford, Sally C, et al. “Constraint Satisfaction Problems: Algorithms and Applications.” *European Journal of Operational Research*, North-Holland, 13 Jan. 2011, [www.sciencedirect.com/science/article/pii/S0377221798003646](http://www.sciencedirect.com/science/article/pii/S0377221798003646).

This source explains the basic components of the constraint satisfaction problems and also explains several real- world examples and steps through how constraint satisfaction can be used to solve them. This source also addresses the use of various and various CSP search algorithms, such as backtracking, forward checking, and MAC(maintaining arc consistency).

Chen, Yarong, et al. “Technology and System of Constraint Programming for Industry Production Scheduling - Part I: A Brief Survey and Potential Directions.” *SpringerLink*, SP Higher Education Press, 26 Aug. 2010, link.springer.com/article/10.1007%2Fs11465-010-0106-x#citeas.

This source explains the benefits of using a constraint programming and also gives a few real-world applications of a CSP.

Rossi, Francesca, and Toby Walsh. “Constraint Programming.” *Handbook of Constraint Programming (Foundations of Artificial Intelligence)*, edited by Peter van Beek, 1st ed., Elsevier, 2006, pp. 83–117.

This chapter of this book goes in-depth into the different algorithms that are used within constraint-satisfaction. Within this chapter, the author explains the various key details and preliminaries needed to get an accurate result from each of the algorithms discussed.

Tatham, Simon. “Chapter 17.” *Dominosa*, Simon Tatham's Portable Puzzle Collection, 2014, [www.chiark.greenend.org.uk/~sgtatham/puzzles/doc/dominosa.html#dominosa](http://www.chiark.greenend.org.uk/~sgtatham/puzzles/doc/dominosa.html#dominosa).

This source describes the topic, Dominosa, and explains the basic rules and objectives of the puzzle.