Approximate matching for Go board positions

Alonso GRAGERA
Graduate School of Information Science and Technology, The University of Tokyo, JAPAN

Introduction

This poster has presented the concepts of *a posteriori* and *a priori* similitudes, and some ways of compute them. These methods are of a general nature and could be potentially applied as a search subroutine of other algorithms including among others: approximate opening book construction, node allocation for message traffic reduction in massive parallelizations, pro-games database clustering, winning-probability approximation by comparison, and combining results from local search of life and death subproblem with MCTS-based algorithms.

Similitude *a posteriori*

Definition 1 *Let $next(x)$ be set of follow up moves of the position $x \in \mathcal{P}$, we can define the similitude as*

$$\hat{s}_{pos}(x, y) = \frac{2\ |next(x) \cap next(y)|}{|next(x)| + |next(y)|}$$

Similitude *a priori*

Definition 2 *Let $\hat{S}(\mathcal{P}, \mathcal{P}, \mathcal{F})$ be a family of similitude measures between two board positions $x, y \in \mathcal{P}$, under a given influence model $f \in \mathcal{F}$, defined by*

$$\hat{s}_f(x, y) = \begin{cases} 1 & if\ x = y \\ |1 - \dfrac{2}{1 + e^{\overline{\alpha \sum \sum |f(x) - f(y)| + \beta}}}| & otherwise \end{cases}$$

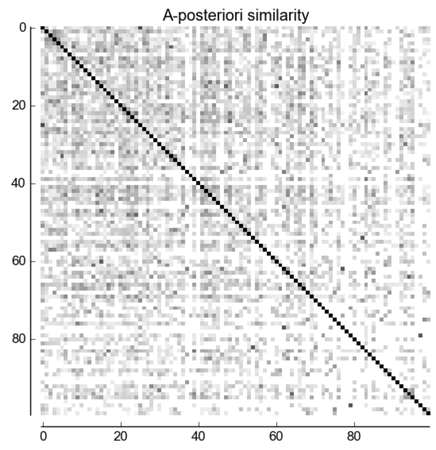
where α, β are a configurable model-dependent parameters.

Experiments

For the experiments in this section the BadukMovies collection consisting on $52,055$ game records between professionals. The positions after the 6th move for each game was selected, and all the different professional replies where clustered, there are 750 unique board positions (excluding with rotations and symmetry). Then, these $562,500$ pairs of positions where compared.

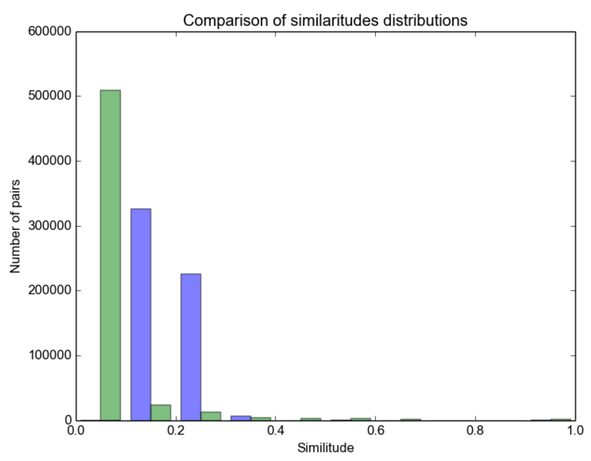
A posteriori insights

By using the *a posteriori* coefficient it can be observed that positions have non-trivial similarity relations among them. Some of the positions are truly very unique, but a relevant fraction of the total have good relations among each others.



A priori insights

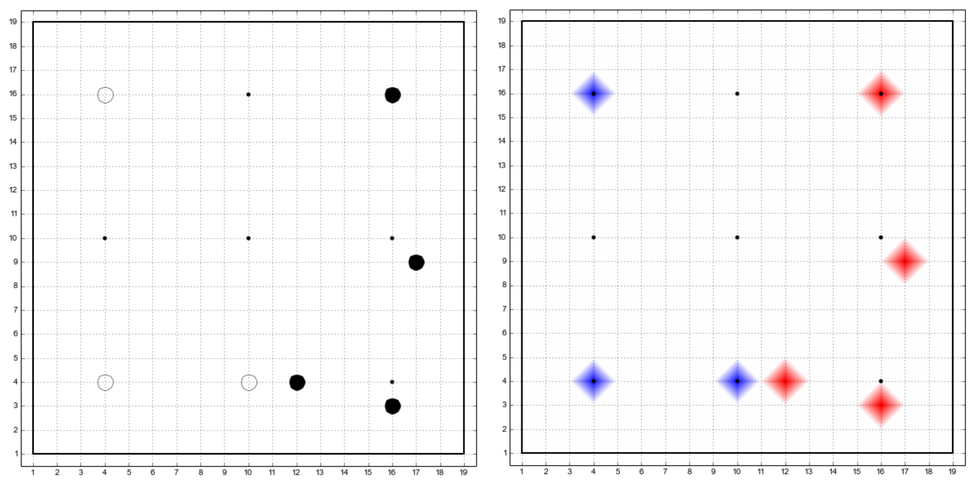
By using the *a priori* coefficient, and optimizing the influence model and the parameters α and β to the stage of the game and intended goal, we can predict the degree of similarity without the expert knowledge required by the *a posteriori* coefficient. A basic example is show in the figure below.



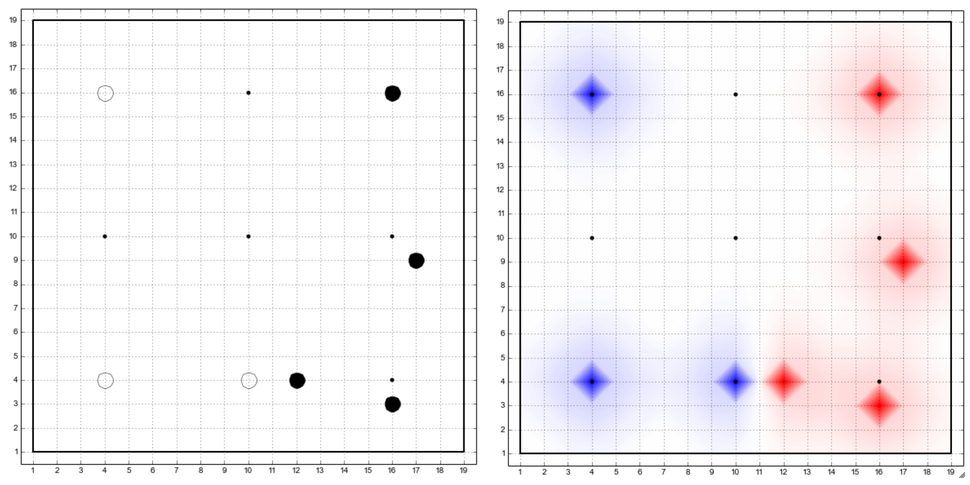
Influence models

Influence models, also known as *influence functions* or *influence maps* are intended to be a representation of how each element of the model exert some effect to its surroundings.
In the past several authors have proposed different models, that are presented below, each one emphasizing a different aspect of the board position.

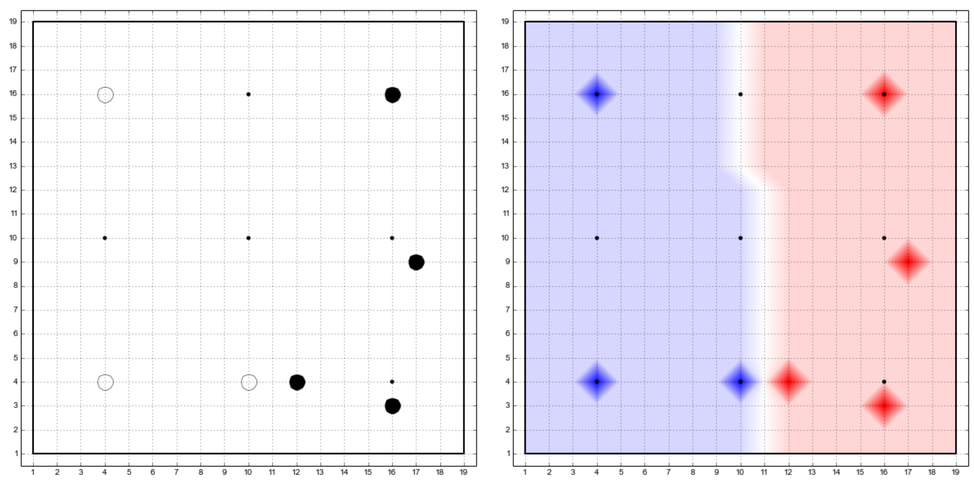
Stones influence model
This is obtained by just initializing the black stones to $+1$, the white stones to -1 and the empty intersection to 0.



Zobrist's influence model
This model is obtained by initialization the black stones to +64, the white stones to -64 and the empty intersections to 0. Then each intersection positive gives +1 to its neighbors (except for the for the ones occupied by stones), and similarly each negative intersection gives -1. The computation is completed after this transmission process is repeated exactly for times.



Spight's influence model
This model finds the equidistant boundaries between groups with opposite colors.



Bouzy's influence model
This model is based in the application of mathematical morphology given by the Zobrist dilation and Zobrist erosion operators.