**Kumoma Algorithm**

1. **what's Kumoma**

Kumoma is a chess game. Two players can take turn place one stone, black and white respectively, until K consecutive stones in a row, let’s say k black stones is in a row, in that case the black wins. It also be called k-in-row. The game board is the mxn grid, within each empty intersection, player can place the stone. [1]

We follow these steps to implementation Kumoma Algorithm：

1. Research the patter of Kumoma, and give each patten a score, the higher score, the higher possible to win.
2. Define the data structure.
3. Design searching algorithm which aims to go through the whole board.
4. Design the value algorithm which using different algorithm, for example game-tree to make the wise decision as human.
5. Trying to using α-β pruning Algorithm to speedy up the decision.
6. Descript how to use these Algorithms within industrial Applications scenario.
7. **The Patten of the Kumoma**

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| --- | --- | --- | --- | --- |
| Pattern | Definition | Expression  （1 black，2 white，0 blank） | Picture[2] | Value |
| Overline | At least five of the same color in an unbroken row, either horizontally, vertically or diagonally. | 11111 | http://imgsrc.baidu.com/forum/w%3D580/sign=ca8f95c4d439b6004dce0fbfd9503526/9230fdfaaf51f3de6bce2f4395eef01f3a2979bb.jpg | 100 |
| Straight four | Four stones of the same color in an unbroken row (horizontally, vertically or diagonally) with both ends open. A straight four ensures a win. | 011110 | http://imgsrc.baidu.com/forum/w%3D580/sign=544199e43b87e9504217f3642038531b/fcf8b48f8c5494ee125e993e2cf5e0fe99257ebb.jpg | 80 |
| Four | Four stones of one color in a row, which in one move can become a five. One end open and another end intercept. Or miss a stone in the middle of one line. | 011112  0101110  0110110 | http://imgsrc.baidu.com/forum/w%3D580/sign=d36b654b113853438ccf8729a313b01f/ff393a292df5e0fe7f641f265d6034a85edf72bb.jpghttp://imgsrc.baidu.com/forum/w%3D580/sign=a21079a34bed2e73fce98624b701a16d/0560f21fbe096b63624ec8770d338744ebf8ac6c.jpg  http://imgsrc.baidu.com/forum/w%3D580/sign=334be987f703738dde4a0c2a831bb073/406c20a4462309f71a183b35730e0cf3d7cad64c.jpg | 70 |
| Straight three | Three stones of the same color in an unbroken row, or with one-intersection gap between the stones that can become a straight four on the next move | 01110  010110 | http://imgsrc.baidu.com/forum/w%3D580/sign=59503004b17eca80120539efa1239712/b3175c6034a85edf66f0680448540923dd5475bb.jpghttp://imgsrc.baidu.com/forum/w%3D580/sign=1bf30a164d086e066aa83f4332087b5a/db0c2834349b033bf8df6afd14ce36d3d539bd6c.jpg | 60 |
| Three | Three stones of the same color which only can become a four on the next move. | 001112  010112  011012  10011  10101  2011102 | http://imgsrc.baidu.com/forum/w%3D580/sign=27e3afe330adcbef01347e0e9caf2e0e/bcf89c82d158ccbf9bc0231d18d8bc3eb13541bb.jpg  http://imgsrc.baidu.com/forum/w%3D580/sign=d09c00db7dd98d1076d40c39113fb807/b318b13533fa828b585f0bc4fc1f4134970a5abb.jpg  http://imgsrc.baidu.com/forum/w%3D580/sign=e942cd111c950a7b75354ecc3ad1625c/3bbd033b5bb5c9eab08495c4d439b6003af3b34c.jpghttp://imgsrc.baidu.com/forum/w%3D580/sign=1e03059c86d6277fe912323018381f63/03158744ebf81a4cc80d7deed62a6059252da684.jpghttp://imgsrc.baidu.com/forum/w%3D580/sign=81c4d19c4610b912bfc1f6f6f3fcfcb5/bc3febc4b74543a9cef36ceb1f178a82b80114d6.jpghttp://imgsrc.baidu.com/forum/w%3D580/sign=63acab3343a7d933bfa8e47b9d4bd194/b7bfa9014c086e06718aae6c03087bf40ad1cb99.jpg | 50 |
| Straight Two | Two stones of the same color which can become a straight three on the next move | 00110  01010  010010 | http://imgsrc.baidu.com/forum/w%3D580/sign=032da31f29381f309e198da199014c67/5e29d9f9d72a6059b82f703d2934349b033bba84.jpghttp://imgsrc.baidu.com/forum/w%3D580/sign=afd63152d788d43ff0a991fa4d1fd2aa/85a4b9014a90f60320580a603812b31bb151edd7.jpghttp://imgsrc.baidu.com/forum/w%3D580/sign=a20cd7e783025aafd3327ec3cbedab8d/74d20ad162d9f2d32433b5c8a8ec8a136327cc99.jpg | 40 |
| Two | Two stones of the same color which only can become a Three on the next move. | 000112  001012  010012  10001  2010102  2011002 | http://imgsrc.baidu.com/forum/w%3D580/sign=e80aca111c950a7b75354ecc3ad1625c/3bbd033b5bb5c9eab1cc92c4d439b6003af3b384.jpghttp://imgsrc.baidu.com/forum/w%3D580/sign=bb97ae6c03087bf47dec57e1c2d3575e/5493c9ea15ce36d3733b12173bf33a87e950b184.jpg  http://imgsrc.baidu.com/forum/w%3D580/sign=f0bb7ed350da81cb4ee683c56267d0a4/893e367adab44aed73a628c3b21c8701a08bfbd7.jpghttp://imgsrc.baidu.com/forum/w%3D580/sign=580e15ea5366d0167e199e20a72ad498/21558bd4b31c8701c05e24c1267f9e2f0608ffd7.jpg  （TBD） | 30 |
| Dead four | Four stones of the same color in two blocked-end row | 211112 | （Omission） | 0 |
| Dead three | Three stones of the same color in two blocked-end row | 21112 | （Omission） | 0 |
| Dead two | Two stones of the same color in two blocked-end row | 2112 | （Omission） | 0 |

1. **The Data structure of the Kumoma**

We use a 2-D array to store the board; and

1. **The value Algorithm of the Kumoma**
2. **The Searching Algorithm of the Kumoma**
3. **The Speed-up Algorithm of the Kumoma**
4. **Game-Tree industrial usage**

Reference

[1] A New Family of k-in-a-row Games from I-Chen Wu and Dei-Yen Huang

[2] <http://tieba.baidu.com/p/2443877229>

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