

基于多人三维五子棋对弈的蒙特卡洛树搜索算法

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基于蒙特卡洛树搜索来解决对弈问题的想法早已有之，然而蒙特卡洛树搜索算法在多人对弈中的研究并不常见。一方面，多人对弈中的情况较为复杂，多方之间的关系并不仅仅是单纯的对抗关系，另外一方面，数的搜索也会随着人数的增加而造成更为复杂的情况。本文用一些相对较为简单的五子棋为例来进行多人对弈的蒙特卡洛树搜索。

关键字：多人对弈、蒙特卡洛树搜索

引言

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Sample Figure

Figure 1 shows an example figure.

Sample Table

Table 1 shows an example table.

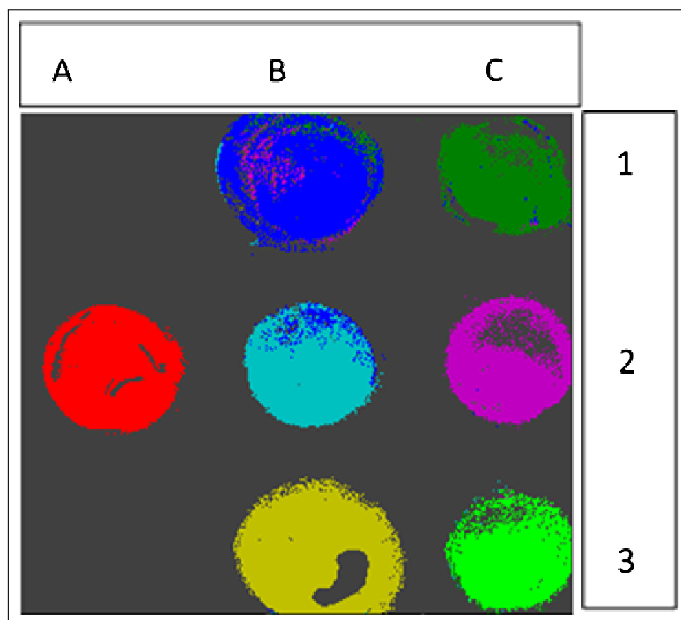


Fig. 1. False-color image, where each pixel is assigned to one of seven reference spectra.

Table 1. Shape Functions for Quadratic Line Elements

local node	$\{N\}_m$	$\{\Phi_i\}_m$ ($i = x, y, z$)
$m = 1$	$L_1(2L_1 - 1)$	Φ_{i1}
$m = 2$	$L_2(2L_2 - 1)$	Φ_{i2}
$m = 3$	$L_3 = 4L_1L_2$	Φ_{i3}

SAMPLE EQUATION

Let X_1, X_2, \dots, X_n be a sequence of independent and identically distributed random variables with $E[X_i] = \mu$ and $\text{Var}[X_i] = \sigma^2 < \infty$, and let

$$S_n = \frac{X_1 + X_2 + \dots + X_n}{n} = \frac{1}{n} \sum_{i=1}^n X_i \quad (1)$$

denote their mean. Then as n approaches infinity, the random variables $\sqrt{n}(S_n - \mu)$ converge in distribution to a normal $\mathcal{N}(0, \sigma^2)$.

SAMPLE ALGORITHM

Algorithms can be included using the commands as shown in algorithm 1.

Algorithm 1. Euclid's algorithm

```

1: procedure EUCLID( $a, b$ )           ▷ The g.c.d. of  $a$  and  $b$ 
2:    $r \leftarrow a \bmod b$ 
3:   while  $r \neq 0$  do               ▷ We have the answer if  $r$  is 0
4:      $a \leftarrow b$ 
5:      $b \leftarrow r$ 
6:      $r \leftarrow a \bmod b$ 
7:   return  $b$                        ▷ The gcd is  $b$ 

```

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Sample Code Citation

2. C. Rivers, “Epipy: Python tools for epidemiology” (Figshare, 2014) [retrieved 13 May 2015], <http://dx.doi.org/10.6084/m9.figshare.1005064>.

REFERENCES

1. Y. Zhang, S. Qiao, L. Sun, Q. W. Shi, W. Huang, L. Li, and Z. Yang, *Photoinduced active terahertz metamaterials with nanostructured vanadium dioxide film deposited by sol-gel method*, Opt. Express **22**, 11070–11078 (2014).
2. .