MM112

komori3

概要

yowa @yowa · 46m

マラソン MM112 の問題はこんな感じ。

少数決のセルオートマトンがある。(距離)^2 <= K の範囲で一番少ない色に変化する（0個は無視・最少タイがある場合は無変化）
NxN の盤面にC色で初期盤面を生成した後、D ステップ進める

(N,D,C,K,盤面)が与えられるので、初期盤面を逆算せよ。一致セル数が得点

Provisional: 10th/47

Rank		User		Score			
Final	Provisional	Rating	Username	Final	Provisional	Time	
-	1	2623	nika	-	88.70618	05 Dec 2019 10:02:03	History (13)
-	2	2340	sullyper	-	87.60757	05 Dec 2019 10:04:03	History (4)
-	3	2579	wleite	-	86.8271	05 Dec 2019 10:52:16	History (16)
-	4	2798	eldidou	-	85.22479	05 Dec 2019 10:53:49	History (13)
-	5	2174	yowa	-	84.61949	05 Dec 2019 08:53:21	History (10)
-	6	2290	Daiver19	-	84.61322	05 Dec 2019 06:18:24	History (20)
-	7	2154	iehn	-	83.96762	05 Dec 2019 09:00:14	History (23)
-	8	1916	tanzaku	-	80.77246	05 Dec 2019 03:41:33	History (3)
-	9	1783	vdave	-	79.44792	05 Dec 2019 01:12:57	History (5)
-	10	1565	my316g	-	78.91508	05 Dec 2019 07:52:30	History (6)
-	11	1625	AmAtUrECoDeR	-	78.82398	03 Dec 2019 12:18:33	History (7)

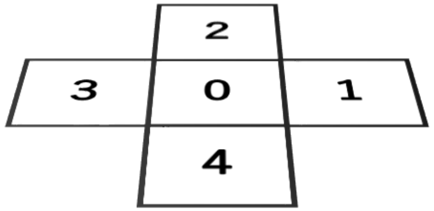
やったこと

1. d日目のマスkの色がcである確率$P(c(d,k)=c)$の計算
   - D日目から0日目(初期盤面)まで日を遡るように確率を伝搬させていくイメージ
   - $\mathrm{argmax}_c\{P(c(0,k)=c) \mid c=0,\dots,C-1\}$ がマスkの推定値
2. スコアが下がりそうなケースを弾く
   - D日目の盤面を0日目の推定値としてそのまま用いる場合: sol1
   - 1. の確率計算を行うもの: sol2
   - 10000ケース使って(N,C,D,K)空間上で線形二値分類

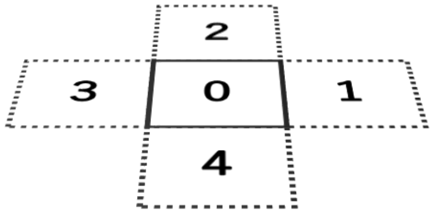
計算パート

d日目のマスkの色がc_dである確率$P(c(d,k)=c_d)$

$$
\begin{aligned}
&P(c(d,k)=c_d)\\
&=\sum\nolimits_{c_{d+1}} P(c(d,k)=c_d, c(d+1,0)=c_{d+1})\\
&=\sum\nolimits_{c_{d+1}} P(c(d,k)=c_d \mid c(d+1,0)=c_{d+1})\,P(c(d+1,0)=c_{d+1})
\end{aligned}
$$



d



$d+1$

$K=1$

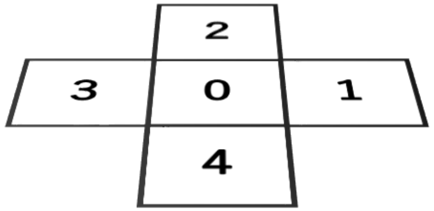
計算パート

d日目のマスkの色がc_dである確率$P(c(d,k)=c_d)$

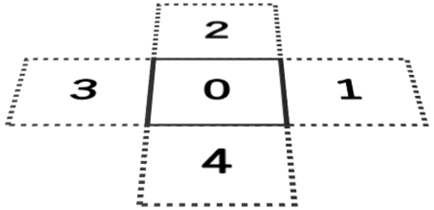
$$
\begin{aligned}
&P(c(d,k)=c_d) \\
&=\sum_{c_{d+1}} P(c(d,k)=c_d, c(d+1,0)=c_{d+1}) \\
&=\sum_{c_{d+1}} \underline{P(c(d,k)=c_d \mid c(d+1,0)=c_{d+1})}\, P(c(d+1,0)=c_{d+1})
\end{aligned}
$$

これが知りたい

$d+1$日目のマス0が色c_{d+1}だったとき、
d日目のマスkが色c_dである確率



d



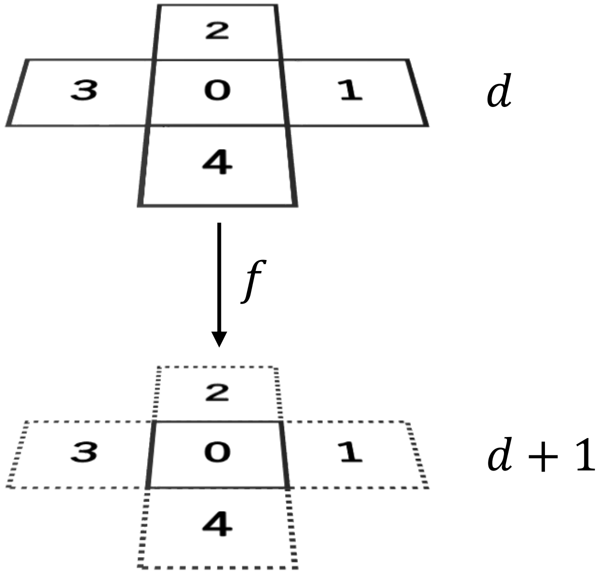
$d+1$

$K=1$

計算パート

$K = 1, C = 4$ を例に考える

- d日目のマス$0, \ldots, 4$の色から$d + 1$日目のマス0の色が決定
- 色集合 $S = \{0,1,2,3\}$ として $f: S^5 \to S$
- 全列挙してみる



$K = 1$

[0,0,0,0,0]->0, [0,0,0,0,1]->1, [0,0,0,0,2]->2, [0,0,0,0,3]->3, [0,0,0,1,0]->1, [0,0,0,1,1]->0, [0,0,0,1,2]->0, [0,0,0,1,3]->0, [0,0,0,2,0]->2, [0,0,0,2,1]->0, [0,0,0,2,2]->0, [0,0,0,2,3]->0, [0,0,0,3,0]->3, [0,0,0,3,1]->0, [0,0,0,3,2]->0, [0,0,0,3,3]->0, [0,0,1,0,0]->1, [0,0,1,0,1]->0, [0,0,1,0,2]->0, [0,0,1,0,3]->0, [0,0,1,1,0]->0, [0,0,1,1,1]->0, [0,0,1,1,2]->0, [0,0,1,1,3]->0

[0,0,1,2,0]->0, [0,0,1,2,1]->0, [0,0,1,2,2]->0, [0,0,1,2,3]->0, [0,0,1,3,0]->0, [0,0,1,3,1]->0, [0,0,1,3,2]->0, [0,0,1,3,3]->0, [0,0,2,0,0]->2, [0,0,2,0,1]->0, [0,0,2,0,2]->0, [0,0,2,0,3]->0, [0,0,2,1,0]->0, [0,0,2,1,1]->0, [0,0,2,1,2]->0, [0,0,2,1,3]->0, [0,0,2,2,0]->0, [0,0,2,2,1]->0, [0,0,2,2,2]->0, [0,0,2,2,3]->0, [0,0,2,3,0]->0, [0,0,2,3,1]->0, [0,0,2,3,2]->0, [0,0,2,3,3]->0

[0,0,3,0,0]->3, [0,0,3,0,1]->0, [0,0,3,0,2]->0, [0,0,3,0,3]->0, [0,0,3,1,0]->0, [0,0,3,1,1]->0, [0,0,3,1,2]->0, [0,0,3,1,3]->0, [0,0,3,2,0]->0, [0,0,3,2,1]->0, [0,0,3,2,2]->0, [0,0,3,2,3]->0, [0,0,3,3,0]->0, [0,0,3,3,1]->0, [0,0,3,3,2]->0, [0,0,3,3,3]->0, [0,1,0,0,0]->1, [0,1,0,0,1]->0, [0,1,0,0,2]->0, [0,1,0,0,3]->0, [0,1,0,1,0]->0, [0,1,0,1,1]->0, [0,1,0,1,2]->0, [0,1,0,1,3]->0

[0,1,0,2,0]->0, [0,1,0,2,1]->0, [0,1,0,2,2]->0, [0,1,0,2,3]->0, [0,1,0,3,0]->0, [0,1,0,3,1]->0, [0,1,0,3,2]->0, [0,1,0,3,3]->0, [0,1,1,0,0]->0, [0,1,1,0,1]->0, [0,1,1,0,2]->0, [0,1,1,0,3]->0, [0,1,1,1,0]->0, [0,1,1,1,1]->1, [0,1,1,1,2]->2, [0,1,1,1,3]->3, [0,1,1,2,0]->0, [0,1,1,2,1]->2, [0,1,1,2,2]->0, [0,1,1,2,3]->0, [0,1,1,3,0]->0, [0,1,1,3,1]->3, [0,1,1,3,2]->0, [0,1,1,3,3]->0

[0,1,2,0,0]->0, [0,1,2,0,1]->0, [0,1,2,0,2]->0, [0,1,2,0,3]->0, [0,1,2,1,0]->0, [0,1,2,1,1]->2, [0,1,2,1,2]->0, [0,1,2,1,3]->0, [0,1,2,2,0]->0, [0,1,2,2,1]->0, [0,1,2,2,2]->1, [0,1,2,2,3]->0, [0,1,2,3,0]->0, [0,1,2,3,1]->0, [0,1,2,3,2]->0, [0,1,2,3,3]->0, [0,1,3,0,0]->0, [0,1,3,0,1]->0, [0,1,3,0,2]->0, [0,1,3,0,3]->0, [0,1,3,1,0]->0, [0,1,3,1,1]->3, [0,1,3,1,2]->0, [0,1,3,1,3]->0

[0,1,3,2,0]->0, [0,1,3,2,1]->0, [0,1,3,2,2]->0, [0,1,3,2,3]->0, [0,1,3,3,0]->0, [0,1,3,3,1]->0, [0,1,3,3,2]->0, [0,1,3,3,3]->1, [0,2,0,0,0]->2, [0,2,0,0,1]->0, [0,2,0,0,2]->0, [0,2,0,0,3]->0, [0,2,0,1,0]->0, [0,2,0,1,1]->0, [0,2,0,1,2]->0, [0,2,0,1,3]->0, [0,2,0,2,0]->0, [0,2,0,2,1]->0, [0,2,0,2,2]->0, [0,2,0,2,3]->0, [0,2,0,3,0]->0, [0,2,0,3,1]->0, [0,2,0,3,2]->0, [0,2,0,3,3]->0

[0,2,1,0,0]->0, [0,2,1,0,1]->0, [0,2,1,0,2]->0, [0,2,1,0,3]->0, [0,2,1,1,0]->0, [0,2,1,1,1]->2, [0,2,1,1,2]->0, [0,2,1,1,3]->0, [0,2,1,2,0]->0, [0,2,1,2,1]->0, [0,2,1,2,2]->1, [0,2,1,2,3]->0, [0,2,1,3,0]->0, [0,2,1,3,1]->0, [0,2,1,3,2]->0, [0,2,1,3,3]->0, [0,2,2,0,0]->0, [0,2,2,0,1]->0, [0,2,2,0,2]->0, [0,2,2,0,3]->0, [0,2,2,1,0]->0, [0,2,2,1,1]->0, [0,2,2,1,2]->1, [0,2,2,1,3]->0

[0,2,2,2,0]->0, [0,2,2,2,1]->1, [0,2,2,2,2]->2, [0,2,2,2,3]->3, [0,2,2,3,0]->0, [0,2,2,3,1]->0, [0,2,2,3,2]->3, [0,2,2,3,3]->0, [0,2,3,0,0]->0, [0,2,3,0,1]->0, [0,2,3,0,2]->0, [0,2,3,0,3]->0, [0,2,3,1,0]->0, [0,2,3,1,1]->0, [0,2,3,1,2]->0, [0,2,3,1,3]->0, [0,2,3,2,0]->0, [0,2,3,2,1]->0, [0,2,3,2,2]->3, [0,2,3,2,3]->0, [0,2,3,3,0]->0, [0,2,3,3,1]->0, [0,2,3,3,2]->0, [0,2,3,3,3]->2

[0,3,0,0,0]->3, [0,3,0,0,1]->0, [0,3,0,0,2]->0, [0,3,0,0,3]->0, [0,3,0,1,0]->0, [0,3,0,1,1]->0, [0,3,0,1,2]->0, [0,3,0,1,3]->0, [0,3,0,2,0]->0, [0,3,0,2,1]->0, [0,3,0,2,2]->0, [0,3,0,2,3]->0, [0,3,0,3,0]->0, [0,3,0,3,1]->0, [0,3,0,3,2]->0, [0,3,0,3,3]->0, [0,3,1,0,0]->0, [0,3,1,0,1]->0, [0,3,1,0,2]->0, [0,3,1,0,3]->0, [0,3,1,1,0]->0, [0,3,1,1,1]->3, [0,3,1,1,2]->0, [0,3,1,1,3]->0

[0,3,1,2,0]->0, [0,3,1,2,1]->0, [0,3,1,2,2]->0, [0,3,1,2,3]->0, [0,3,1,3,0]->0, [0,3,1,3,1]->0, [0,3,1,3,2]->0, [0,3,1,3,3]->1, [0,3,2,0,0]->0, [0,3,2,0,1]->0, [0,3,2,0,2]->0, [0,3,2,0,3]->0, [0,3,2,1,0]->0, [0,3,2,1,1]->0, [0,3,2,1,2]->0, [0,3,2,1,3]->0, [0,3,2,2,0]->0, [0,3,2,2,1]->0, [0,3,2,2,2]->3, [0,3,2,2,3]->0, [0,3,2,3,0]->0, [0,3,2,3,1]->0, [0,3,2,3,2]->0, [0,3,2,3,3]->2

[0,3,3,0,0]->0, [0,3,3,0,1]->0, [0,3,3,0,2]->0, [0,3,3,0,3]->0, [0,3,3,1,0]->0, [0,3,3,1,1]->0, [0,3,3,1,2]->0, [0,3,3,1,3]->1, [0,3,3,2,0]->0, [0,3,3,2,1]->0, [0,3,3,2,2]->0, [0,3,3,2,3]->2, [0,3,3,3,0]->0, [0,3,3,3,1]->1, [0,3,3,3,2]->2, [0,3,3,3,3]->3, [1,0,0,0,0]->0, [1,0,0,0,1]->1, [1,0,0,0,2]->2, [1,0,0,0,3]->3, [1,0,0,1,0]->1, [1,0,0,1,1]->1, [1,0,0,1,2]->1, [1,0,0,1,3]->1

[1,0,0,2,0]->2, [1,0,0,2,1]->1, [1,0,0,2,2]->1, [1,0,0,2,3]->1, [1,0,0,3,0]->3, [1,0,0,3,1]->1, [1,0,0,3,2]->1, [1,0,0,3,3]->1, [1,0,1,0,0]->1, [1,0,1,0,1]->1, [1,0,1,0,2]->1, [1,0,1,0,3]->1, [1,0,1,1,0]->1, [1,0,1,1,1]->0, [1,0,1,1,2]->1, [1,0,1,1,3]->1, [1,0,1,2,0]->1, [1,0,1,2,1]->1, [1,0,1,2,2]->1, [1,0,1,2,3]->1, [1,0,1,3,0]->1, [1,0,1,3,1]->1, [1,0,1,3,2]->1, [1,0,1,3,3]->1

[1,0,2,0,0]->2, [1,0,2,0,1]->1, [1,0,2,0,2]->1, [1,0,2,0,3]->1, [1,0,2,1,0]->1, [1,0,2,1,1]->1, [1,0,2,1,2]->1, [1,0,2,1,3]->1, [1,0,2,2,0]->1, [1,0,2,2,1]->1, [1,0,2,2,2]->0, [1,0,2,2,3]->1, [1,0,2,3,0]->1, [1,0,2,3,1]->1, [1,0,2,3,2]->1, [1,0,2,3,3]->1, [1,0,3,0,0]->3, [1,0,3,0,1]->1, [1,0,3,0,2]->1, [1,0,3,0,3]->1, [1,0,3,1,0]->1, [1,0,3,1,1]->1, [1,0,3,1,2]->1, [1,0,3,1,3]->1

[1,0,3,2,0]->1, [1,0,3,2,1]->1, [1,0,3,2,2]->1, [1,0,3,2,3]->1, [1,0,3,3,0]->1, [1,0,3,3,1]->1, [1,0,3,3,2]->1, [1,0,3,3,3]->0, [1,1,0,0,0]->1, [1,1,0,0,1]->1, [1,1,0,0,2]->1, [1,1,0,0,3]->1, [1,1,0,1,0]->1, [1,1,0,1,1]->0, [1,1,0,1,2]->1, [1,1,0,1,3]->1, [1,1,0,2,0]->1, [1,1,0,2,1]->1, [1,1,0,2,2]->1, [1,1,0,2,3]->1, [1,1,0,3,0]->1, [1,1,0,3,1]->1, [1,1,0,3,2]->1, [1,1,0,3,3]->1

[1,1,1,0,0]->1, [1,1,1,0,1]->0, [1,1,1,0,2]->1, [1,1,1,0,3]->1, [1,1,1,1,0]->0, [1,1,1,1,1]->1, [1,1,1,1,2]->2, [1,1,1,1,3]->3, [1,1,1,2,0]->1, [1,1,1,2,1]->2, [1,1,1,2,2]->1, [1,1,1,2,3]->1, [1,1,1,3,0]->1, [1,1,1,3,1]->3, [1,1,1,3,2]->1, [1,1,1,3,3]->1, [1,1,2,0,0]->1, [1,1,2,0,1]->1, [1,1,2,0,2]->1, [1,1,2,0,3]->1, [1,1,2,1,0]->1, [1,1,2,1,1]->2, [1,1,2,1,2]->1, [1,1,2,1,3]->1

[1,1,2,2,0]->1, [1,1,2,2,1]->1, [1,1,2,2,2]->1, [1,1,2,2,3]->1, [1,1,2,3,0]->1, [1,1,2,3,1]->1, [1,1,2,3,2]->1, [1,1,2,3,3]->1, [1,1,3,0,0]->1, [1,1,3,0,1]->1, [1,1,3,0,2]->1, [1,1,3,0,3]->1, [1,1,3,1,0]->1, [1,1,3,1,1]->3, [1,1,3,1,2]->1, [1,1,3,1,3]->1, [1,1,3,2,0]->1, [1,1,3,2,1]->1, [1,1,3,2,2]->1, [1,1,3,2,3]->1, [1,1,3,3,0]->1, [1,1,3,3,1]->1, [1,1,3,3,2]->1, [1,1,3,3,3]->1

[1,2,0,0,0]->2, [1,2,0,0,1]->1, [1,2,0,0,2]->1, [1,2,0,0,3]->1, [1,2,0,1,0]->1, [1,2,0,1,1]->1, [1,2,0,1,2]->1, [1,2,0,1,3]->1, [1,2,0,2,0]->1, [1,2,0,2,1]->1, [1,2,0,2,2]->0, [1,2,0,2,3]->1, [1,2,0,3,0]->1, [1,2,0,3,1]->1, [1,2,0,3,2]->1, [1,2,0,3,3]->1, [1,2,1,0,0]->1, [1,2,1,0,1]->1, [1,2,1,0,2]->1, [1,2,1,0,3]->1, [1,2,1,1,0]->1, [1,2,1,1,1]->2, [1,2,1,1,2]->1, [1,2,1,1,3]->1

[1,2,1,2,0]->1, [1,2,1,2,1]->1, [1,2,1,2,2]->1, [1,2,1,2,3]->1, [1,2,1,3,0]->1, [1,2,1,3,1]->1, [1,2,1,3,2]->1, [1,2,1,3,3]->1, [1,2,2,0,0]->1, [1,2,2,0,1]->1, [1,2,2,0,2]->0, [1,2,2,0,3]->1, [1,2,2,1,0]->1, [1,2,2,1,1]->1, [1,2,2,1,2]->1, [1,2,2,1,3]->1, [1,2,2,2,0]->0, [1,2,2,2,1]->1, [1,2,2,2,2]->2, [1,2,2,2,3]->3, [1,2,2,3,0]->1, [1,2,2,3,1]->1, [1,2,2,3,2]->3, [1,2,2,3,3]->1

[1,2,3,0,0]->1, [1,2,3,0,1]->1, [1,2,3,0,2]->1, [1,2,3,0,3]->1, [1,2,3,1,0]->1, [1,2,3,1,1]->1, [1,2,3,1,2]->1, [1,2,3,1,3]->1, [1,2,3,2,0]->1, [1,2,3,2,1]->1, [1,2,3,2,2]->3, [1,2,3,2,3]->1, [1,2,3,3,0]->1, [1,2,3,3,1]->1, [1,2,3,3,2]->1, [1,2,3,3,3]->2, [1,3,0,0,0]->3, [1,3,0,0,1]->1, [1,3,0,0,2]->1, [1,3,0,0,3]->1, [1,3,0,1,0]->1, [1,3,0,1,1]->1, [1,3,0,1,2]->1, [1,3,0,1,3]->1

[1,3,0,2,0]->1, [1,3,0,2,1]->1, [1,3,0,2,2]->1, [1,3,0,2,3]->1, [1,3,0,3,0]->1, [1,3,0,3,1]->1, [1,3,0,3,2]->1, [1,3,0,3,3]->0, [1,3,1,0,0]->1, [1,3,1,0,1]->1, [1,3,1,0,2]->1, [1,3,1,0,3]->1, [1,3,1,1,0]->1, [1,3,1,1,1]->3, [1,3,1,1,2]->1, [1,3,1,1,3]->1, [1,3,1,2,0]->1, [1,3,1,2,1]->1, [1,3,1,2,2]->1, [1,3,1,2,3]->1, [1,3,1,3,0]->1, [1,3,1,3,1]->1, [1,3,1,3,2]->1, [1,3,1,3,3]->1

[1,3,2,0,0]->1, [1,3,2,0,1]->1, [1,3,2,0,2]->1, [1,3,2,0,3]->1, [1,3,2,1,0]->1, [1,3,2,1,1]->1, [1,3,2,1,2]->1, [1,3,2,1,3]->1, [1,3,2,2,0]->1, [1,3,2,2,1]->1, [1,3,2,2,2]->3, [1,3,2,2,3]->1, [1,3,2,3,0]->1, [1,3,2,3,1]->1, [1,3,2,3,2]->1, [1,3,2,3,3]->2, [1,3,3,0,0]->1, [1,3,3,0,1]->1, [1,3,3,0,2]->1, [1,3,3,0,3]->0, [1,3,3,1,0]->1, [1,3,3,1,1]->1, [1,3,3,1,2]->1, [1,3,3,1,3]->1

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[2,2,0,2,0]->2, [2,2,0,2,1]->2, [2,2,0,2,2]->0, [2,2,0,2,3]->2, [2,2,0,3,0]->2, [2,2,0,3,1]->2, [2,2,0,3,2]->2, [2,2,0,3,3]->2, [2,2,1,0,0]->2, [2,2,1,0,1]->2, [2,2,1,0,2]->2, [2,2,1,0,3]->2, [2,2,1,1,0]->2, [2,2,1,1,1]->2, [2,2,1,1,2]->2, [2,2,1,1,3]->2, [2,2,1,2,0]->2, [2,2,1,2,1]->2, [2,2,1,2,2]->1, [2,2,1,2,3]->2, [2,2,1,3,0]->2, [2,2,1,3,1]->2, [2,2,1,3,2]->2, [2,2,1,3,3]->2

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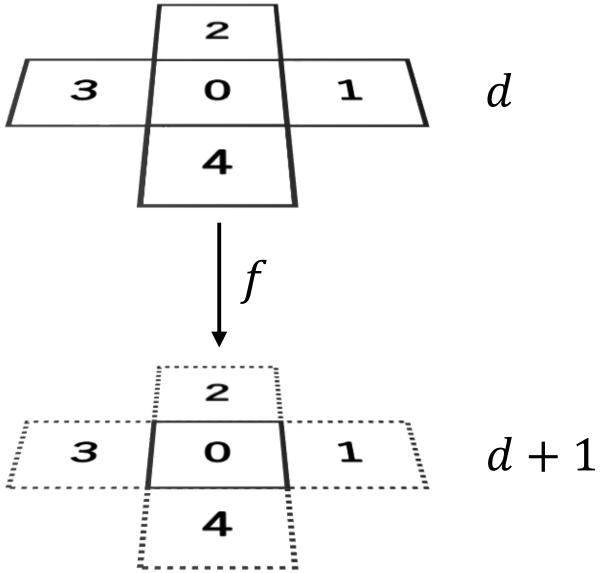
→ $d+1$日目のマス0が色c_{d+1}だったとき、d日目のマスkが色c_dである場合の数 $a[k][c_{d+1}][c_d]$ を求める

計算パート

$K = 1, C = 4$ を例に考える

- d日目のマス$0, \ldots, 4$の色から$d+1$日目のマス0の色が決定
- 色集合 $S = \{0,1,2,3\}$ として $f: S^5 \to S$
- 全列挙してみる
- $d+1$日目のマス0が色c_{d+1}だったとき、d日目のマスkが色c_dである場合の数 $a[k][c_{d+1}][c_d]$ を求める



$K = 1$

計算パート

$K = 1, C = 4$ を例に考える

- d日目のマス$0, \ldots, 4$の色から$d+1$日目のマス0の色が決定
- 色集合 $S = \{0,1,2,3\}$ として $f: S^5 \to S$
- 全列挙してみる
- $d+1$日目のマス0が色c_{d+1}だったとき、d日目のマスkが色c_dである場合の数 $a[k][c_{d+1}][c_d]$ を求める

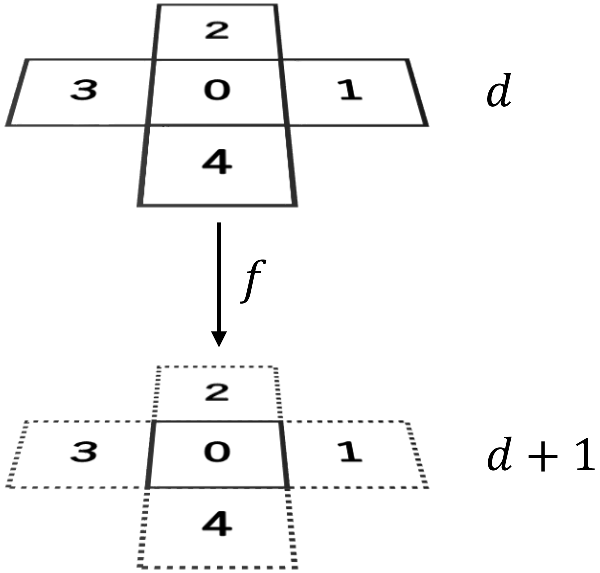
k=0	0	1	2	3
0	217	13	13	13
1	13	217	13	13
2	13	13	217	13
3	13	13	13	217

1	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

2	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

3	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

4	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67



$K = 1$

計算パート

$K = 1, C = 4$ を例に考える

- 4通りを考慮

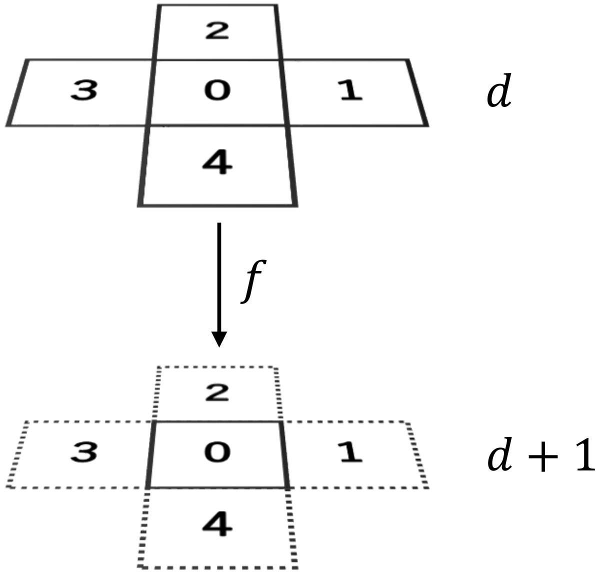
k=0	0	1	2	3
0	217	13	13	13
1	13	217	13	13
2	13	13	217	13
3	13	13	13	217

1	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

2	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

3	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

4	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

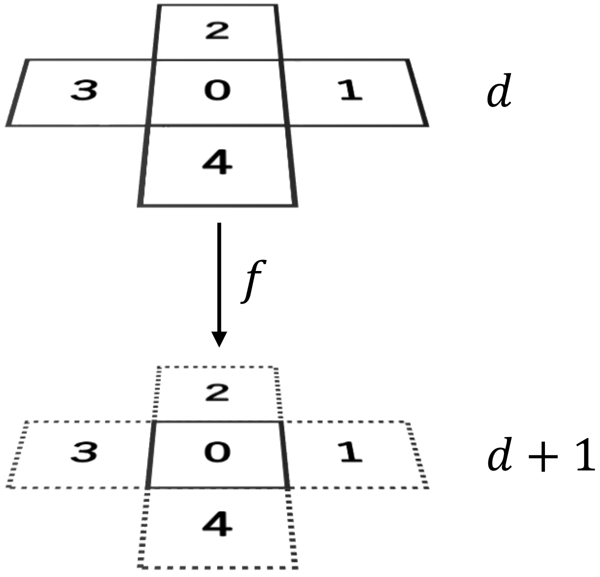


$K = 1$

計算パート

$K = 1, C = 4$ を例に考える

- 4通りを考慮
  1. $k = 0 \land c_{d+1} \neq c_d$ (13)



$K = 1$

k=0	0	1	2	3
0	217	13	13	13
1	13	217	13	13
2	13	13	217	13
3	13	13	13	217

1	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

2	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

3	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

4	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

計算パート

$K = 1, C = 4$ を例に考える

- 4通りを考慮
  1. $k = 0 \wedge c_{d+1} \neq c_d$ (13)
  2. $k = 0 \wedge c_{d+1} = c_d$ (217)

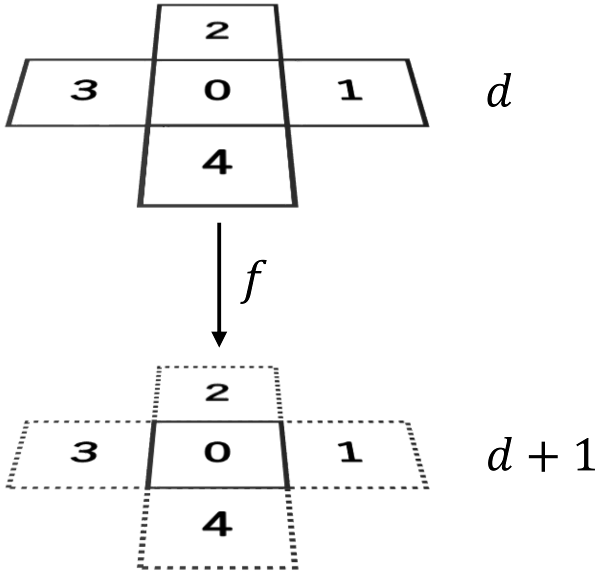
k=0	0	1	2	3
0	217	13	13	13
1	13	217	13	13
2	13	13	217	13
3	13	13	13	217

1	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

2	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

3	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

4	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67



$K = 1$

計算パート

$K = 1, C = 4$ を例に考える

- 4通りを考慮
  1. $k = 0 \land c_{d+1} \neq c_d$ (13)
  2. $k = 0 \land c_{d+1} = c_d$ (217)
  3. $k \neq 0 \land c_{d+1} \neq c_d$ (63)

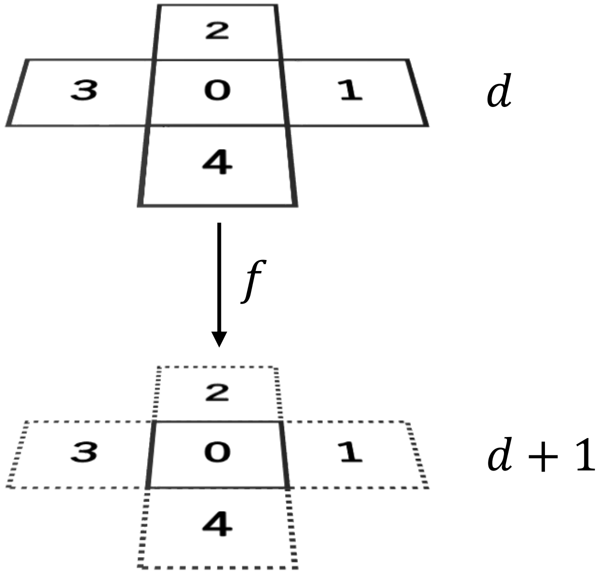
k=0	0	1	2	3
0	217	13	13	13
1	13	217	13	13
2	13	13	217	13
3	13	13	13	217

1	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

2	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

3	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

4	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67



$K = 1$

計算パート

$K = 1, C = 4$ を例に考える

- 4通りを考慮
  1. $k = 0 \wedge c_{d+1} \neq c_d$ (13)
  2. $k = 0 \wedge c_{d+1} = c_d$ (217)
  3. $k \neq 0 \wedge c_{d+1} \neq c_d$ (63)
  4. $k \neq 0 \wedge c_{d+1} = c_d$ (67)

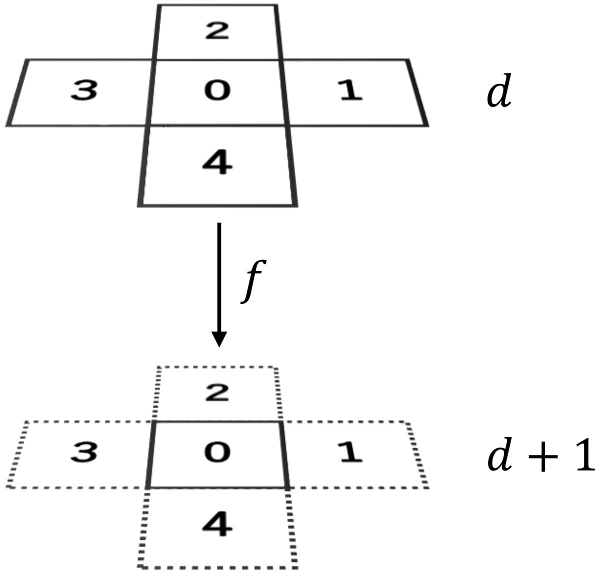
k=0	0	1	2	3
0	217	13	13	13
1	13	217	13	13
2	13	13	217	13
3	13	13	13	217

1	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

2	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

3	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

4	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67



$K = 1$

計算パート

$K=1, C=4$ を例に考える

- 4通りを考慮
  1. $k=0 \land c_{d+1} \neq c_d$ (13)
  2. $k=0 \land c_{d+1} = c_d$ $(217 = C^4 - 13 * (C-1))$
  3. $k \neq 0 \land c_{d+1} \neq c_d$ $(63 = (C^4 - 67) \div (C-1))$
  4. $k \neq 0 \land c_{d+1} = c_d$ (67)
- 4つの場合の数（本質的には2つ）を求めればいい

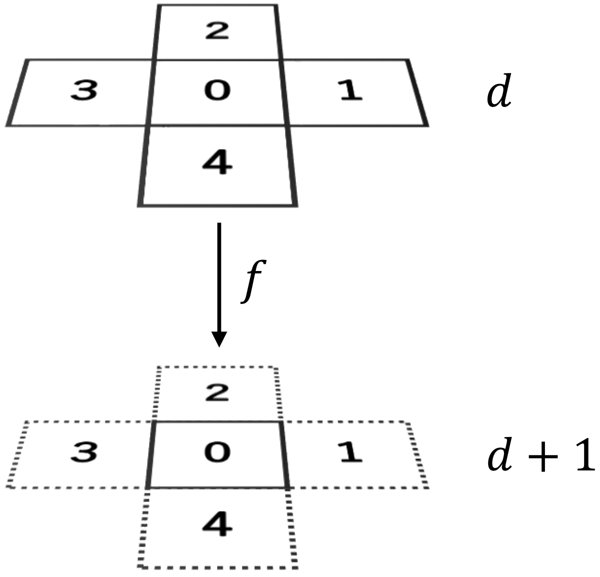
k=0	0	1	2	3
0	217	13	13	13
1	13	217	13	13
2	13	13	217	13
3	13	13	13	217

1	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

2	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

3	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

4	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67



$K=1$

計算パート

$K = 1, C = 4$ を例に考える

- 4通りを考慮
  1. $k = 0 \land c_{d+1} \neq c_d$ (13)
  2. $k = 0 \land c_{d+1} = c_d$ $(217 = C^4 - 13 * (C - 1))$
  3. $k \neq 0 \land c_{d+1} \neq c_d$ $(63 = (C^4 - 67) \div (C - 1))$
  4. $k \neq 0 \land c_{d+1} = c_d$ (67)
- 4つの場合の数（本質的には2つ）を求めればいい

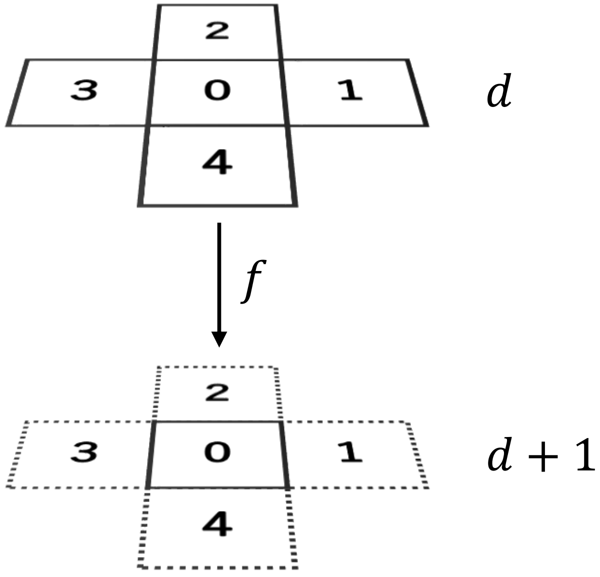
k=0	0	1	2	3
0	217	13	13	13
1	13	217	13	13
2	13	13	217	13
3	13	13	13	217

1	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

2	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

3	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67

4	0	1	2	3
0	67	63	63	63
1	63	67	63	63
2	63	63	67	63
3	63	63	63	67



$K = 1$

計算パート

すべての $(k, C) \mid \{k = 2, \dots, 36, C = 2, \dots, 8\}$ について計算して、埋め込み

```
memo[2][4][0] = 0.4375; memo[2][4][1] = 0.1875; memo[2][4][2] = 0.8125; memo[2][4][3] = 0.0625;
memo[2][5][0] = 0.36; memo[2][5][1] = 0.16; memo[2][5][2] = 0.84; memo[2][5][3] = 0.04;
memo[2][6][0] = 0.3055555555555556; memo[2][6][1] = 0.1388888888888889; memo[2][6][2] = 0.8611111111111112; memo[2][6][
memo[2][7][0] = 0.2653061224489796; memo[2][7][1] = 0.12244897959183673; memo[2][7][2] = 0.8775510204081632; memo[2][7]
memo[2][8][0] = 0.234375; memo[2][8][1] = 0.109375; memo[2][8][2] = 0.890625; memo[2][8][3] = 0.015625;
memo[3][2][0] = 0.5; memo[3][2][1] = 0.5; memo[3][2][2] = 0.5; memo[3][2][3] = 0.5;
memo[3][3][0] = 0.4074074074074074; memo[3][3][1] = 0.2962962962962963; memo[3][3][2] = 0.48148148148148145; memo[3][3]
memo[3][4][0] = 0.34375; memo[3][4][1] = 0.21875; memo[3][4][2] = 0.53125; memo[3][4][3] = 0.15625;
memo[3][5][0] = 0.296; memo[3][5][1] = 0.176; memo[3][5][2] = 0.584; memo[3][5][3] = 0.104;
memo[3][6][0] = 0.25925925925925924; memo[3][6][1] = 0.14814814814814814; memo[3][6][2] = 0.6296296296296297; memo[3][6]
memo[3][7][0] = 0.2303206997084548; memo[3][7][1] = 0.1282798833819242; memo[3][7][2] = 0.6676384839650146; memo[3][7][
memo[3][8][0] = 0.20703125; memo[3][8][1] = 0.11328125; memo[3][8][2] = 0.69921875; memo[3][8][3] = 0.04296875;
memo[4][2][0] = 0.4375; memo[4][2][1] = 0.5625; memo[4][2][2] = 0.6875; memo[4][2][3] = 0.3125;
memo[4][3][0] = 0.3333333333333333; memo[4][3][1] = 0.3333333333333333; memo[4][3][2] = 0.7777777777777778; memo[4][3][
memo[4][4][0] = 0.26171875; memo[4][4][1] = 0.24609375; memo[4][4][2] = 0.84765625; memo[4][4][3] = 0.05078125;
memo[4][5][0] = 0.2128; memo[4][5][1] = 0.1968; memo[4][5][2] = 0.8912; memo[4][5][3] = 0.0272;
memo[4][6][0] = 0.17824074074074073; memo[4][6][1] = 0.16435185185185186; memo[4][6][2] = 0.9189814814814815; memo[4][6]
memo[4][7][0] = 0.15285297792586422; memo[4][7][1] = 0.1411911703456893; memo[4][7][2] = 0.9375260308204915; memo[4][7]
memo[4][8][0] = 0.133544921875; memo[4][8][1] = 0.123779296875; memo[4][8][2] = 0.950439453125; memo[4][8][3] = 0.00708
memo[5][2][0] = 0.375; memo[5][2][1] = 0.625; memo[5][2][2] = 0.5; memo[5][2][3] = 0.5;
memo[5][3][0] = 0.29218106995884774; memo[5][3][1] = 0.35390946502057613; memo[5][3][2] = 0.49794238683127573; memo[5][
memo[5][4][0] = 0.25; memo[5][4][1] = 0.25; memo[5][4][2] = 0.6015625; memo[5][4][3] = 0.1328125;
memo[5][5][0] = 0.21408; memo[5][5][1] = 0.19648; memo[5][5][2] = 0.69152; memo[5][5][3] = 0.07712;
memo[5][6][0] = 0.18467078189300412; memo[5][6][1] = 0.16306584362139917; memo[5][6][2] = 0.7582304526748971; memo[5][6]
memo[5][7][0] = 0.16106384244659963; memo[5][7][1] = 0.13982269292556673; memo[5][7][2] = 0.8068661867079193; memo[5][7]
memo[5][8][0] = 0.14208984375; memo[5][8][1] = 0.12255859375; memo[5][8][2] = 0.8427734375; memo[5][8][3] = 0.02246093
memo[6][2][0] = 0.375; memo[6][2][1] = 0.625; memo[6][2][2] = 0.65625; memo[6][2][3] = 0.34375;
memo[6][3][0] = 0.24554183813443073; memo[6][3][1] = 0.3772290809327846; memo[6][3][2] = 0.5528120713305898; memo[6][3]
```

36 の分割パターンは 約 17000 なので列挙可能 (多倍長: python で)

やったこと

1. d日目のマスkの色がcである確率$P(c(d,k)=c)$の計算
    - D日目から0日目(初期盤面)まで日を遡るように確率を伝搬させていくイメージ
    - $\mathrm{argmax}_c\{P(c(0,k)=c) \mid c=0,\dots,C-1\}$ がマスkの推定値

2. スコアが下がりそうなケースを弾く
    - D日目の盤面を0日目の推定値としてそのまま用いる場合: sol1
    - 1. の確率計算を行うもの: sol2
    - 10000ケース使って(N,C,D,K)空間上で線形二値分類

分類パート

- スコアが下がりそうなケースを弾く
  - 前述のなんちゃって確率で推定した初期盤面は、大幅にスコア改善するケースもあれば大幅に改悪するケースもある
  - 団子ゾーンから 1 点くらいしか上がらない

  - 残り 6 時間でできること
  - 改悪しそうなやつはそのままにする→線形二値分類

  - Excel 芸となんちゃって焼きなまし分類で 10 位

  - N,D 固定して線形モデル 50 個で殴ると 1,2 点上がった？（間に合わず…）