MEC Cache Replacement Policy -Heuristic Algorithm

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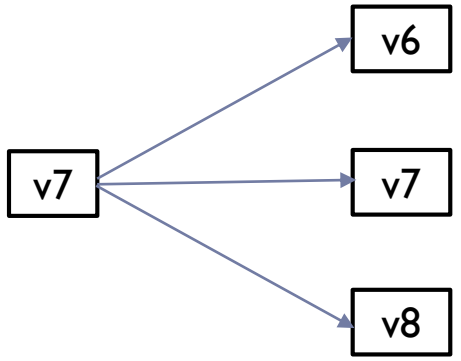
Heuristic Algorithm

任何論文在設計heuristic時，緊咬問題特性與該論文idea

我的論文會談到的特性以及我考慮的點:

1. View transition dependency
2. VR view range request
3. 紀錄多人目前在看哪個角度的view
4. DIBR synthesis range 和 VR view range 關聯



使用者在一段角度內東看西看

V = {3,4}

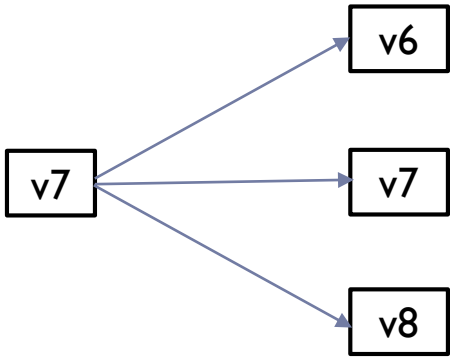
	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10
N:	0	0	0	2	1	0	0	0	0	0

R = 5

Heuristic Algorithm

Idea 1:

- Extract the intrinsic idea behind view transition dependency.

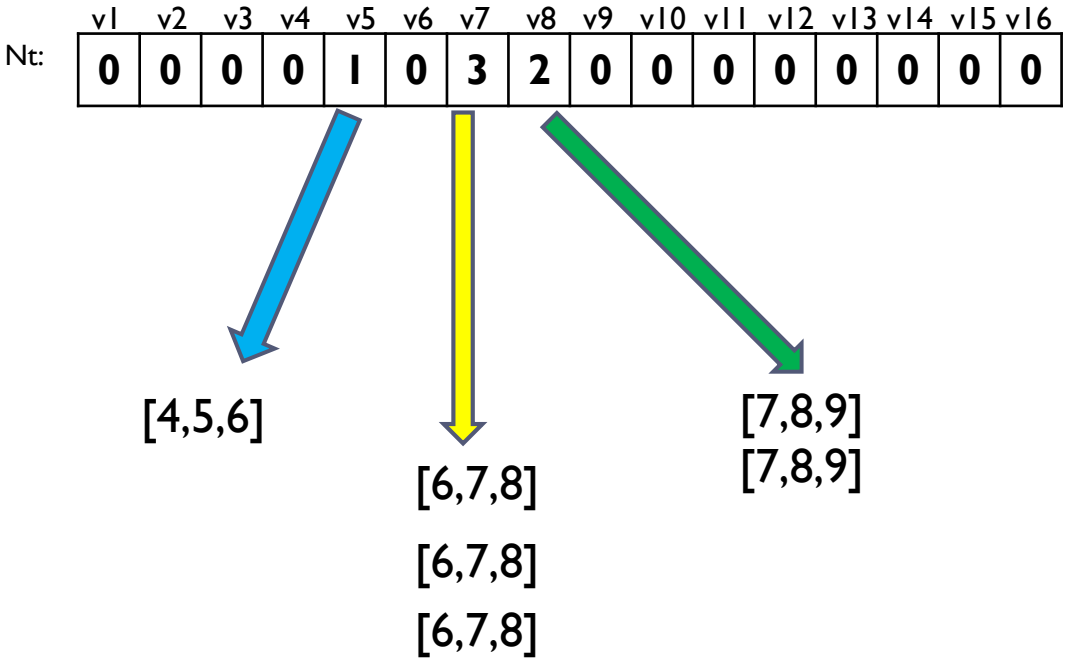


As far as possible fetch the current view near left side or right side, and evict the view beyond this range. (e.g. As the above example, possibly fetch v6,v7,v8 and evict v1,v2,v3,v4,v5,v9,v10,…)

Heuristic Algorithm

Idea 2:

- Extract the intrinsic idea behind view transition dependency and multiple users.

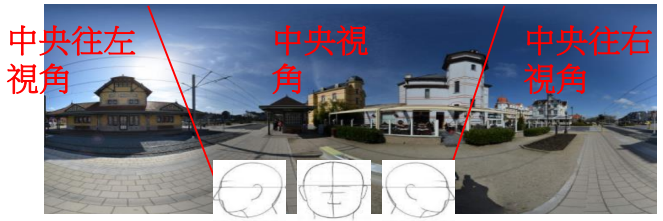


[4,5,6]
[6,7,8]
[6,7,8]
[6,7,8]
[7,8,9]
[7,8,9]

Arrange the view rank.

Fetch the view overlapped the most, and evict the view overlapped the least.

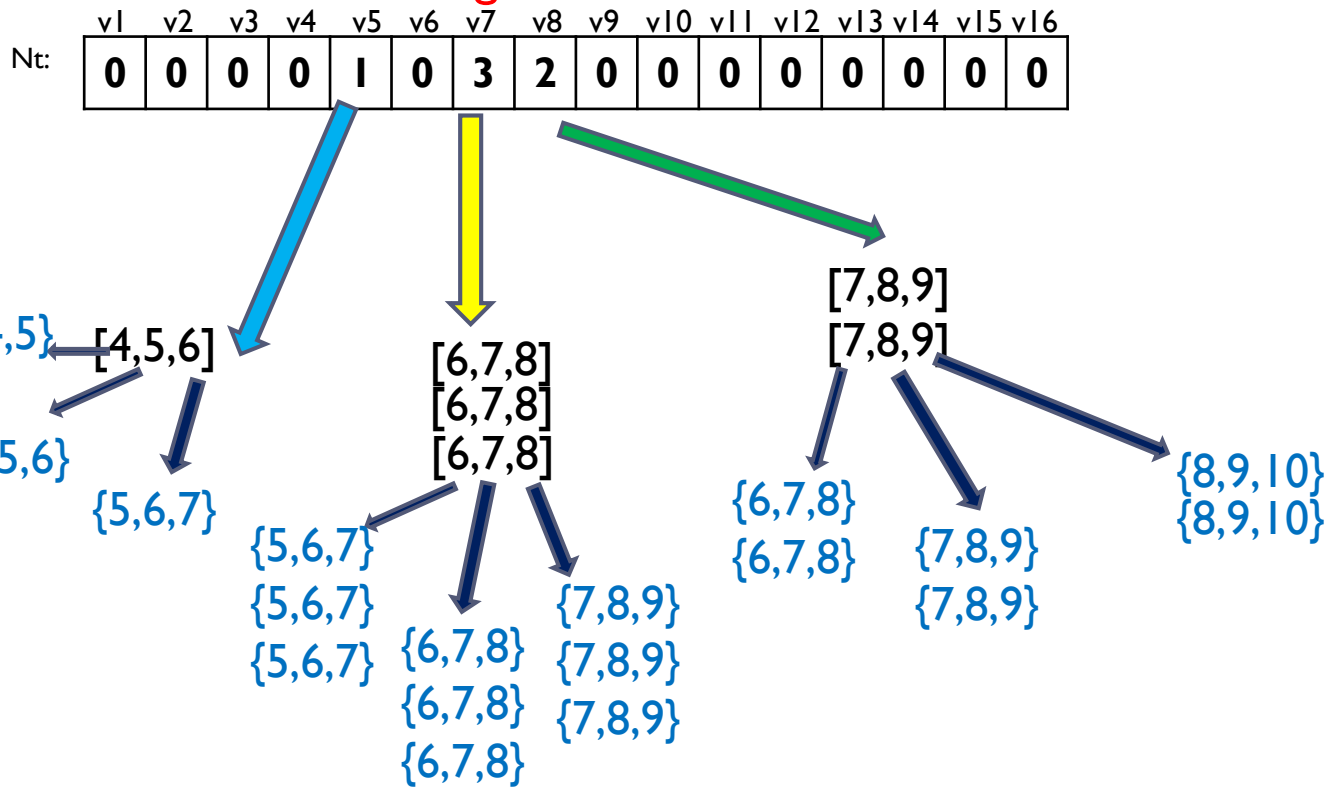
Heuristic Algorithm



使用者在一段角度內東看西看

Idea 3:

- Extract the intrinsic idea behind view transition dependency, multiple users , and VR view range.



3,4,5
4,5,6
5,6,7
5,6,7
5,6,7
5,6,7
6,7,8
6,7,8
6,7,8
6,7,8
6,7,8
7,8,9
7,8,9
7,8,9
7,8,9
7,8,9
8,9,10
8,9,10

P(v3),P(v4),…,P(v10)

Arrange the view rank.

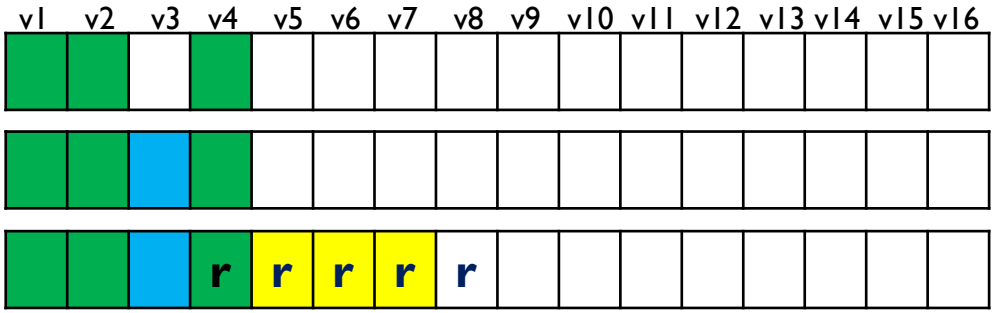
Fetch the view overlapped the most, and evict the view overlapped the least.

Heuristic Algorithm

Idea 4:

- Extract the intrinsic idea behind relationship between DIBR synthesis range and VR view range.

Vt={1,2,4} , DIBR constraint=3
Rt={4,5,6,7,8}←VR range=5



Heuristic Algorithm

Definition:

τ_i：去遠端拿**view i** 的負面效益。**(**遠端拿的成本**-**下一刻該**view**出現的機率**)**
$\mu_{h,j}$：滿足**view h~j**，所花最低的**total**成本。

c_f：遠端拿一個**view**的成本。

P(vi)：下一刻**view i** 出現的機率

τ_i **=** $c_f - \beta * P(vi)$

$\mu_{h,j}$ **=** $\min_{(j-D \le k<j, h \le k)} \tau_j + \mu_{h,k} + \alpha$***(j-k)*(j-k-1)**

Goal: calculate $\mu_{h,h}$, …, $\mu_{h,j}$, …, $\mu_{h,t}$ step by step with the dynamic programing above, and decide which views to fetch and which views to synthesize.

Heuristic Algorithm (Example)

τ_i：去遠端拿view i 的負面效益。(遠端拿的成本-下一刻該view出現的機率)
$\mu_{h,j}$：滿足view h~j，所花最低的total成本。
c_f：遠端拿一個view的成本。
P(vi)：下一刻view i 出現的機率

$\tau_i = c_f - \beta * P(vi)$

$\mu_{h,j} = \min_{(j-D \le k<j, h \le k)} \tau_j + \mu_{h,k} + \alpha$*(j-k)*(j-k-1)

Vt={1,2,4} , DIBR constraint=3
Rt={4,5,6,7,8}←VR range=5

v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	v11	v12	v13	v14	v15	v16
			r	r	r	r	r								

calculate $\mu_{4,4}$, …, $\mu_{4,8}$ step by step as follow:

$\mu_{4,4} = 0$
$\mu_{4,5} = \tau_5 + \mu_{4,4} = c_f - \beta * P(v5) \leftarrow$ (拿$v5$)

$$\mu_{4,6} = \begin{cases} \tau_6 + \mu_{4,4} + \alpha * 2 * 1 = c_f - \beta P(v6) + 2\alpha \leftarrow (拿v6。v5用v4,v6合成) \\ \tau_6 + \mu_{4,5} = 2c_f - \beta[P(v5) + P(v6)] \leftarrow (拿v6和v5) \end{cases}$$

$$\mu_{4,7} = \begin{cases} \tau_7 + \mu_{4,4} + \alpha * 3 * 2 = c_f - \beta[P(v7)] + 6\alpha \leftarrow (拿v7。v5,v6用v4,v7合成) \\ \tau_7 + \mu_{4,5} + \alpha * 2 * 1 = 2c_f - \beta[P(v5) + P(v7)] + 2\alpha \leftarrow (拿v7和v5。v6用v5,v7合成) \\ \tau_7 + \mu_{4,6} = 2c_f - \beta[P(v6) + P(v7)] + 2\alpha \leftarrow (拿v7,v6。v5用v4,v6合成) \end{cases}$$

$$\mu_{4,8} = \begin{cases} \tau_8 + \mu_{4,5} + \alpha * 3 * 2 = 2c_f - \beta[P(v5) + P(v8)] + 6\alpha \leftarrow (拿v8和v5。v6,v7用v5,v8合成) \\ \tau_8 + \mu_{4,6} + \alpha * 2 * 1 = 2c_f - \beta[P(v6) + P(v8)] + 4\alpha \leftarrow (拿v8和v6。v5用v4,v6合成。v7用v6,v8合成) \\ \tau_8 + \mu_{4,7} = 3c_f - \beta[P(v6) + P(v7) + P(v8)] + 2\alpha \leftarrow (拿v8和v7和v6。v5用v4,v6合成) \end{cases}$$