

Rough meaning	Feature index	Meaning (t is the corresponding tile)
Hand of player 0	0	If player 0 has $\geq 1$ t in hand
	1	If player 0 has $\geq 2$ t in hand
	2	If player 0 has $\geq 3$ t in hand
	3	If player 0 has 4 t in hand
	4	If player 0 has discarded t in this game
	5	If player 0 has Red Dora t in hand
Callings of player 0 (melding from discarded tiles)	6	If player 0 has $\geq 1$ t in callings
	7	If player 0 has $\geq 2$ t in callings
	8	If player 0 has $\geq 3$ t in callings
	9	If player 0 has 4 t in callings
	10	If player 0 has $\geq 1$ t in callings and t is from other's discarded tiles
	11	If player 0 has Red Dora t in callings
Callings of player 1	12 to 17	Same as 5 to 11, but for player 1
Callings of player 2	18 to 23	Same as 5 to 11, but for player 2
Callings of player 3	24 to 29	Same as 5 to 11, but for player 3
Discarded tiles from player 0	30	If player 0 has discarded $\geq 1$ t
	31	If player 0 has discarded $\geq 2$ t
	32	If player 0 has discarded $\geq 3$ t
	33	If player 0 has 4 t in calling
	34	If player 0's first discarded t is Tegiri (if applicable)
	35	If player 0's second discarded t is Tegiri (if applicable)
	36	If player 0's third discarded t is Tegiri (if applicable)
	37	If player 0's fourth discarded t is Tegiri (if applicable)
	38	If player 0 has discarded Red Dora t
	39	If player 0 has discarded t to annouce Riichi
Discarded tiles from player 1	40 to 49	Same as 30-39, but for player 1
Discarded tiles from player 2	50 to 59	Same as 30-39, but for player 2
Discarded tiles from player 3	60 to 69	Same as 30-39, but for player 3
Other public information	70	If t is Dora indicator ( $\geq 1$ repeats)
	71	If t is Dora indicator ( $\geq 2$ repeats)
	72	If t is Dora indicator ( $\geq 3$ repeats)
	73	If t is Dora indicator (4 repeats)
	74	If t is Dora ( $\geq 1$ repeats)
	75	If t is Dora ( $\geq 2$ repeats)
	76	If t is Dora ( $\geq 3$ repeats)
	77	If t is Dora (4 repeats)
	78	If t is wind of the table
	79	If t is wind of self
The tile of the latest action	80	If t is the tile corresponding to the latest action
Information for available actions	81	If at t is in player 0's hand
	82	If at t can be Chi, and is the smallest in the meld
	83	If at t can be Chi, and is the middle in the meld
	84	If at t can be Chi, and is the largest in the meld
	85	If at t can be Pong
	86	If at t can be An-Kan
	87	If at t can be Kan
	88	If at t can be Ka-Kan
	89	If Riichi is possible by discarding t
	90	If t is the latest discarded tile from others enabling RonAgari
	91	If t is the latest drawn tile enabling Tsumo
	92	If t is Kyuhai and is in player 0's hand
Hand of player 1 (only for oracle)	93 to 98	Same as 0 to 5, but for player 1
Hand of player 2 (only for oracle)	99 to 104	Same as 0 to 5, but for player 2
Hand of player 3 (only for oracle)	104 to 110	Same as 0 to 5, but for player 3

Table 1: Explanation of the 111 features of oracle observations encoding (the first 93 features are available to the executor) of our Mahjong environment. Player 0 is the current player who is making decision and player 1, 2, 3 are opponents counterclockwise. Tegiri (“discard from hand”) means the tile is not discarded immediately after drawing it.

Action index	Explanation
0	Discard Character 1
1	Discard Character 2
2	Discard Character 3
3	Discard Character 4
4	Discard Character 5 (non-Red Dora with higher priority)
5	Discard Character 6
6	Discard Character 7
7	Discard Character 8
8	Discard Character 9
9	Discard Dot 1
10	Discard Dot 2
11	Discard Dot 3
12	Discard Dot 4
13	Discard Dot 5 (non-Red Dora with higher priority)
14	Discard Dot 6
15	Discard Dot 7
16	Discard Dot 8
17	Discard Dot 9
18	Discard Bamboo 1
19	Discard Bamboo 2
20	Discard Bamboo 3
21	Discard Bamboo 4
22	Discard Bamboo 5 (non-Red Dora with higher priority)
23	Discard Bamboo 6
24	Discard Bamboo 7
25	Discard Bamboo 8
26	Discard Bamboo 9
27	Discard East Wind
28	Discard South Wind
29	Discard West Wind
30	Discard North Wind
31	Discard White Dragon Tile (Haku)
32	Discard Green Dragon Tile (Hatsu)
33	Discard Red Dragon Tile (Chu)
34	Chi (the picked up tile is the smallest in the meld)
35	Chi (the picked up tile is the middle in the meld)
36	Chi (the picked up tile is the largest in the meld)
37	Pon
38	An-Kan
39	Kan
40	Ka-Kan
41	Riichi
42	Ron
43	Tsumo
44	Restart the game with Kyushukyuha
45	Not to Riichi (When Riichi is possible)
46	Not to response (when Chi, Pon, Kan, Ron, etc. is possible)

Table 2: Action encoding of our Mahjong environment.