



# IJCAI 2020 Mahjong AI Competition

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# Content

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# Background

□ Mahjong is a four-player imperfect information game

**南 South [SurprisingBaseline] 得得得得得得得得**  
-28 pt

**西 West 王维林here**  
-28 pt

**东 East 和了 Make Mahjong.**  
84 pt [infinityedge]岭上开花

**北 North [cqkmxpr]exp**  
-28 pt

妙手回春(8番) + 不求人(4番) + 和绝张(4番) + 喜相逢(1番) + 无字(1番)  
+ 嵌张(1番) + 花牌(1番)  
总计: 20番

Last Tile Draw(8pt) + Fully Concealed Hand(4pt) + Last Tile(4pt) +  
Mixed Double Chow(1pt) + No Honours(1pt) + Closed Wait(1pt)  
+ Flower Tile(1pt)  
Total: 20 pt

西风圈, 牌墙剩余0张。 Round West. 0 tiles remaining.



# Related Work

## □ Rule-based method

- Try to win as soon as possible
- Drawback:
  - ✓ Ignore opponents' tactics
  - ✓ Hard to defend

## □ Supervised learning

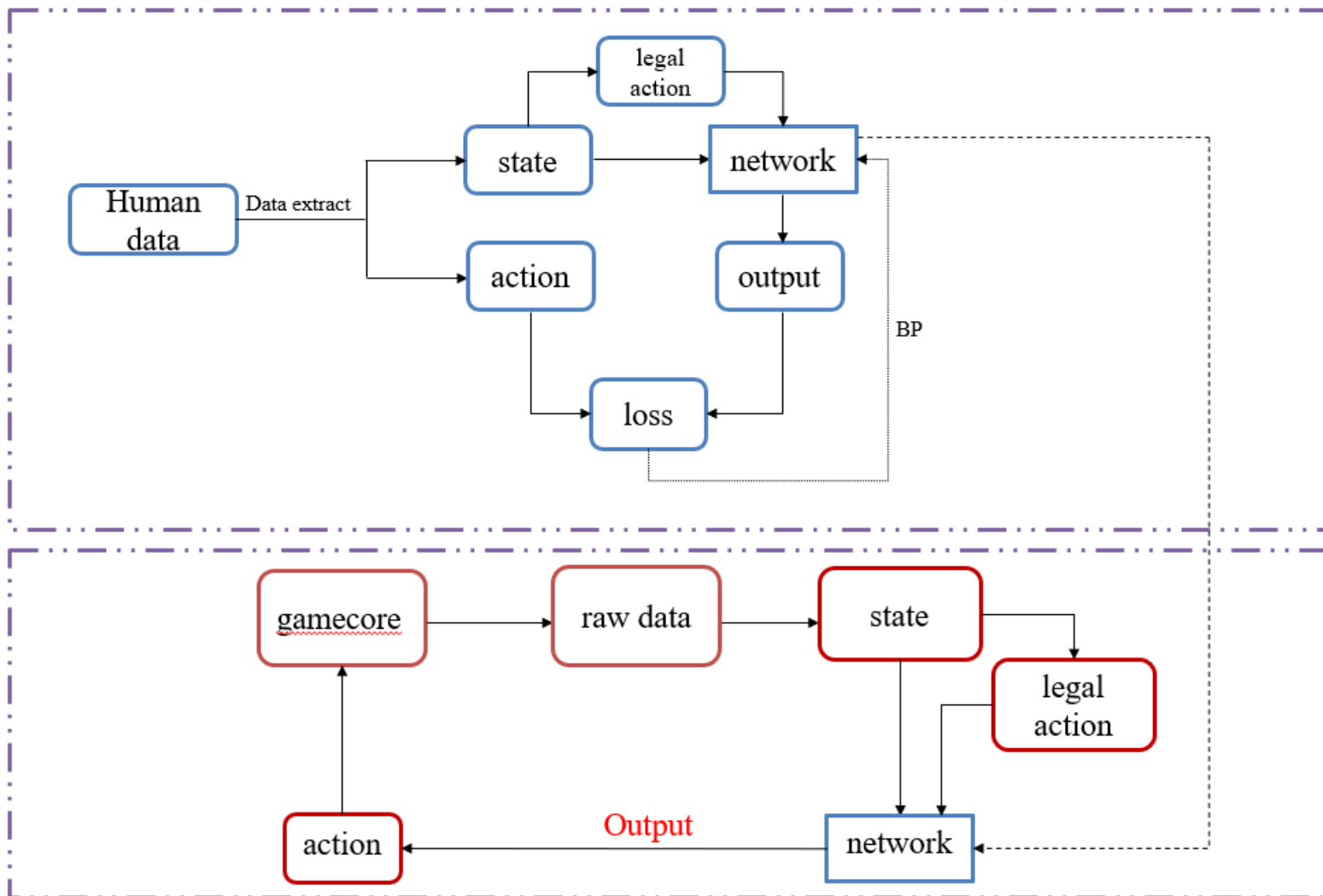
- Simulate human experts' tactics
- Drawback :
  - ✓ Require huge amounts of data
  - ✓ Lack of overall view of the whole game

## □ Self play + reinforcement learning

- Learn how to play by itself from zero
- Drawback:
  - ✓ Require a significant amount of computing resources

# Method

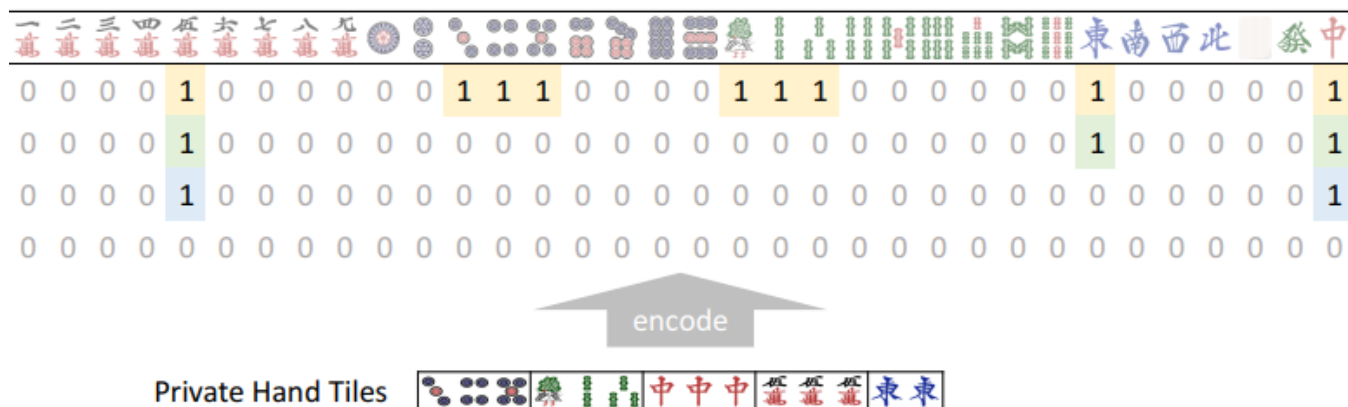
- Based on our research environment, we chose supervised learning





# State

## □ Draw on the experience of Suphx



## □ Improvement:

- Change the size of tensor from 1\*34 to 4\*9, in order to enhance the perception of winning hands like 'Mixed Shifted Pungs' and 'Mixed Triple Chow', which are the most common winning hands in human games.
- Reduce the number of channel. Our state tensor includes private hand tiles, exposed meld of four players, exposed tiles in discard area and remaining unknown tiles, which amounts to 145 channels.



# Action

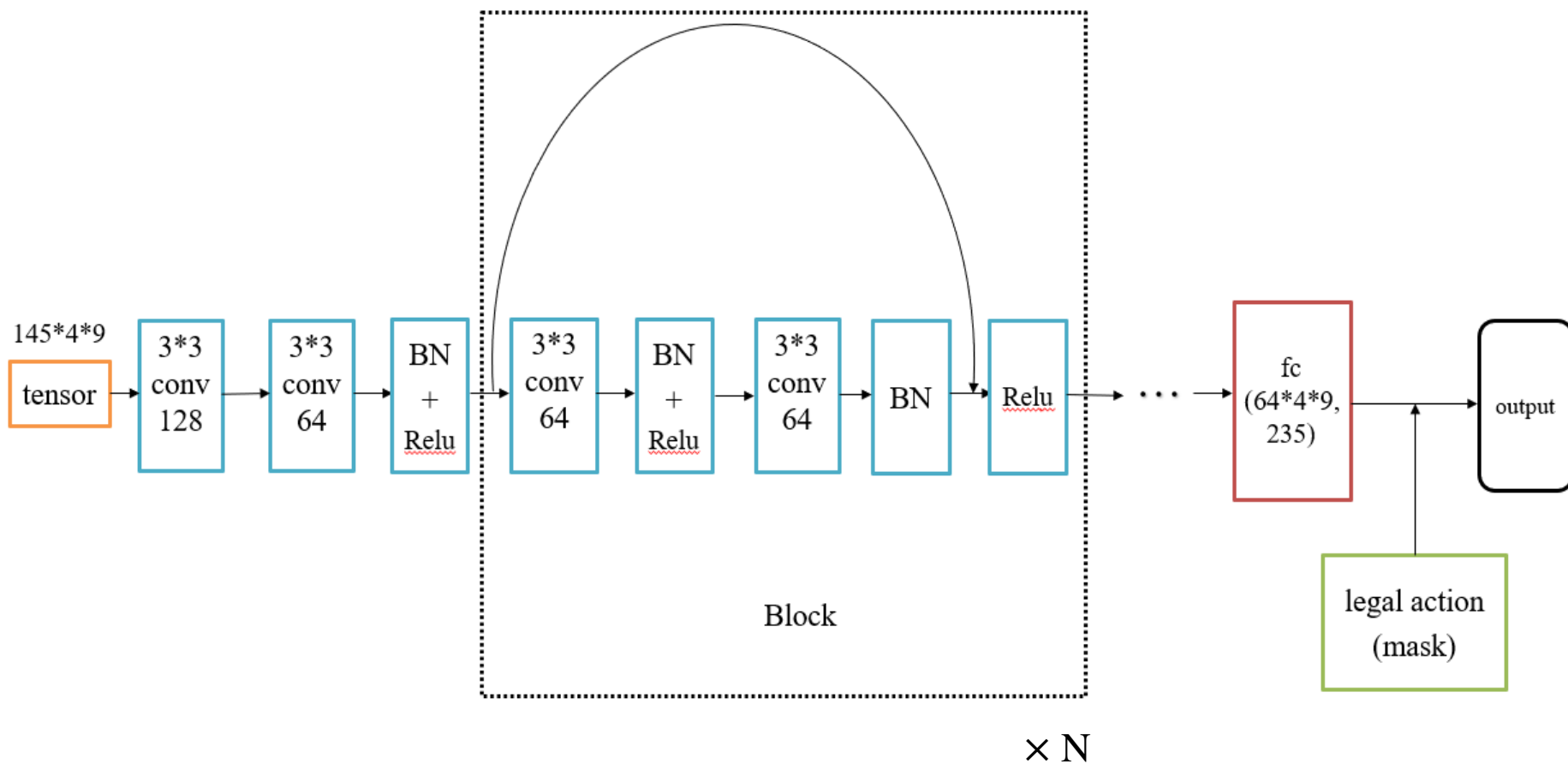
Type of instruction	Number	Instruction code
PASS	1	0
Win	1	35
Discard	34	Characters(1~9) Bamboos(10~18) Dots(19~27) Wind(28~31) Cardinal(32~34)
Kong	34	Characters(36~44) Bamboos(45~53) Dots(54~62) Wind(63~66) Cardinal(67~69)
ClosedKong	34	Characters(70~78) Bamboos(79~87) Dots(88~96) Wind(97~100) Cardinal(101~103)
AddKong	34	Characters(104~112) Bamboos(113~121) Dots(122~130) Wind(131~134) Cardinal(135~137)
Pung	34	Characters(138~146) Bamboos(147~155) Dots(156~164) Wind(165~168) Cardinal(169~171)
Chow	63	Characters(172~192) Bamboos(193~213) Dots(214~234)

Chow (Characters)	172	173	174	175	176	177	178
Actions	23_1	34_2	45_3	56_4	67_5	78_6	89_7
Chow (Characters)	172	173	174	175	176	177	178
Actions	23_1	34_2	45_3	56_4	67_5	78_6	89_7
Chow (Characters)	172	173	174	175	176	177	178
Actions	23_1	34_2	45_3	56_4	67_5	78_6	89_7

⋮

Chow (Dots)	214	215	216	217	218	219	220
Actions	23_1	34_2	45_3	56_4	67_5	78_6	89_7
Chow (Dots)	221	222	223	224	225	226	227
Actions	23_1	34_2	45_3	56_4	67_5	78_6	89_7
Chow (Dots)	228	229	230	231	232	233	234
Actions	23_1	34_2	45_3	56_4	67_5	78_6	89_7

# Model







# Data

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## Data source :

- [https://www.botzone.org.cn/static/gamecontest2020a\\_cn.html](https://www.botzone.org.cn/static/gamecontest2020a_cn.html)

## Data cleaning

- Delete the games with error
- Reserve the winner's pairs of state and action of every game

## Data enhancement

- Exchange bamboos, characters and dots
- Exchange number 1 and 9, 2 and 8, 3 and 7, 4 and 6

# Experiments

- The results of local evaluation (20000 games, play with three random bots)

Network structure	Data enhancement	Way of enhancement	SL model	Winning ratio	Ave points per game
resnet18	✗	—	13675	0.68375	30.1898
	✓	Exchange the three suits	14411	0.72055	32.01885
	✓	Exchange the numbers	14325	0.71625	31.8008
	✓	Both	14577	0.72885	32.27015
resnet34	✗	—	13271	0.66355	29.36045
	✓	Exchange the three suits	14222	0.7111	31.65665
	✓	Exchange the numbers	14262	0.7131	31.61745
	✓	Both	14455	0.72275	31.97545
resnet50	✗	—	13841	0.69205	30.3981
	✓	Exchange the three suits	14518	0.72055	32.01885
	✓	Exchange the numbers	14388	0.7194	31.8221
	✓	Both	14625	0.73125	32.4011



# Experiments

- Rank top in the community on Dec 28th

1	地锅鸡	luyd_cpp	1319.87	res网络	6	.py36  ID
2	李大爷	李大爷	1318.41	退休打打麻将	17	.py36  ID
3	从零单排	工行卡十六号嘴	1298.01	11	11	.py36  ID
4	雀圣2021	metaphysics	1294.68	玄学大师	1	.cpp17  ID
5	近似随机	cbxg	1280.56	test	11	.cpp17a  ID
6	QAQ	Rp_Zes	1276.76	gg	6	.cpp17a  ID
7	岭上开花	infinityedge	1274.75	垃圾评测机	5	.cpp17  ID
8	jong	ilovemahjong	1273.66	bot	11	.py36  ID
9	lalala	Doug	1272.35	...	17	.cpp17  ID
10	humanfy	humanfy	1264.62	test	2	.cpp17a  ID

