2019 AIIDE Starcraft AI Competition

Report and Results

David Churchill, Richard Kelly

Memorial University of Newfoundland

St. John's, NL, Canada

St. John's

Newfoundland and Labrador
Canada

Mostly Sunny · 51°F
5:46 PM

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Photos

Quick facts

St. John's, a city on Newfoundland island off Canada's Atlantic coast, is the capital of Newfoundland and Labrador province. Its harbour was settled by the British in the 1600s. Downtown is known for its colourful row houses. Above the city is Signal Hill with walking trails and the site of the first transatlantic wireless communication, Cabot Tower, which commemorates John Cabot's discovery of Newfoundland.

Hotels

About pricing

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Satellite

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Hudson Bay
North Atlantic Ocean
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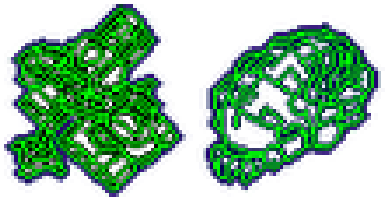


BWAPI


10

Tournament Results

www.StarcraftAICompetition.com

“Results / Files”

http://www.cs.mun.ca/~dchurchill/starcraftaicomp/2019/

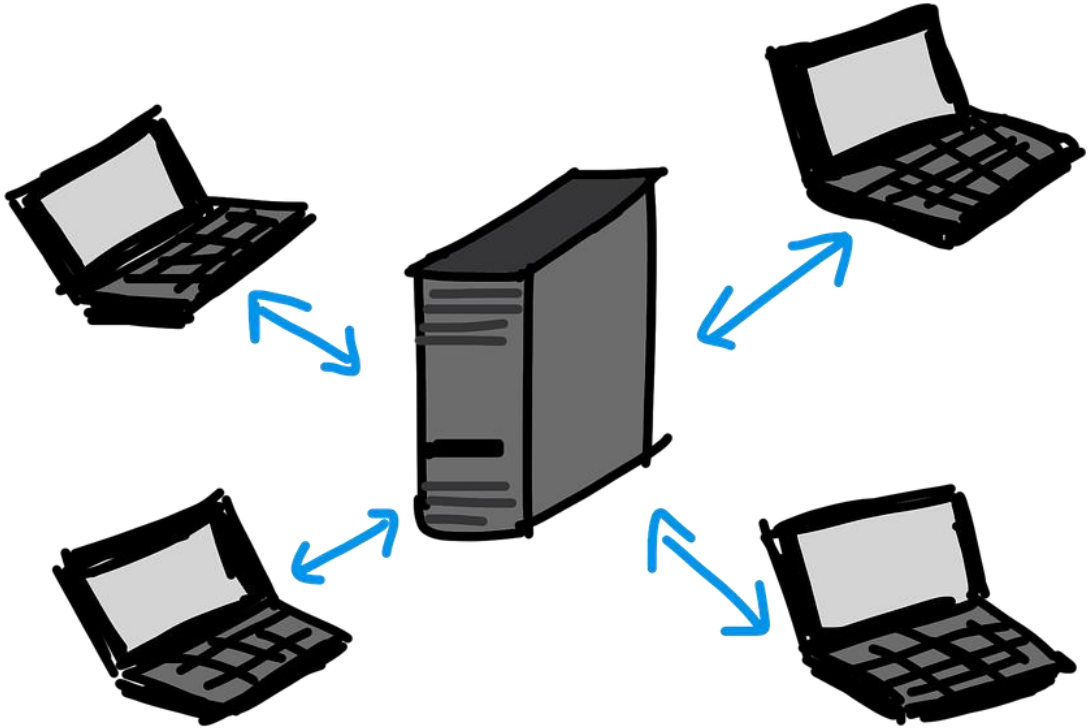
Tournament Format

- Full Game – Starcraft Broodwar
  - Fog of War Enabled
- Round Robin Format
  - 1v1 Games
  - Bots ranked by final win percentage

Game Rules

- 60 minute game time-limit
  - Tie break with in-game score
- No cheating or in-game glitches
  - Disqualified if cheating found
- Bots penalized for slow computations
  - Game loss if bot goes over computation limit
- File I/O - Learning

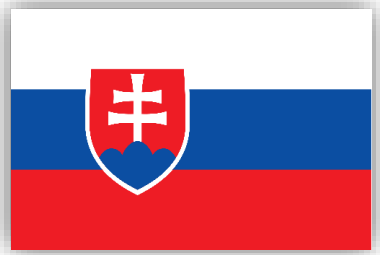
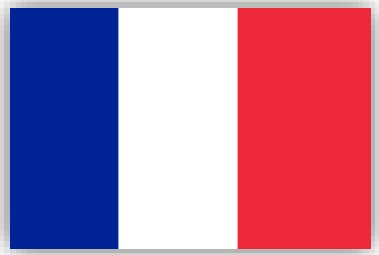
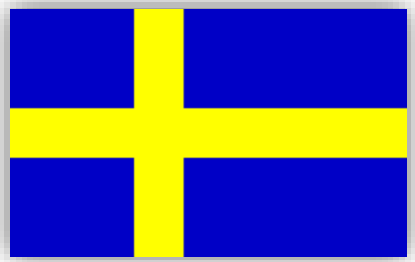
Why Not StarCraft 2?

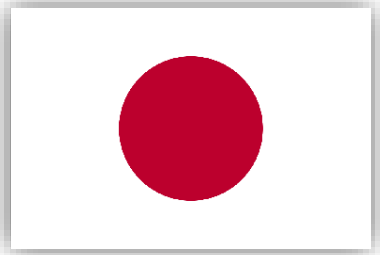


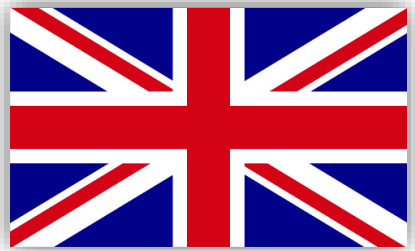
Bot Name	Author Name	Affiliation	Race	BWAPI	Type	Opt-Out	Status	Submit
AITP	Yang Xia	Turing Lab & CPSS Lab	Terran	4.4.0	dll	Yes	2019 Registered	COMPILED + TESTED
BananaBrain	Johan de Jong	Independent	Protoss	4.4.0	dll	No	2019 Registered	COMPILED + TESTED
BunkerBoxeR	Haoda Fan	University of Waterloo	Terran	4.4.0	dll	Yes	2019 Registered	COMPILED + TESTED
DaQin	Lion GIS	Independent	Protoss	4.1.2	dll	No	2019 Registered	COMPILED + TESTED
Locutus	Bruce Nielsen	Independent	Protoss	4.1.2	dll	No	2019 Registered	COMPILED + TESTED
McRave	Christian McCrave	Independent	Protoss	4.4.0	dll	No	2019 Registered	COMPILED + TESTED
Microwave	Micky Holdorf	Independent	Zerg	4.4.0	dll	No	2019 Registered	COMPILED + TESTED
PurpleWave	Dan Gant	Independent	Protoss	4.1.2	client	No	2019 Registered	COMPILED + TESTED
Steamhammer	Jay Scott	Independent	Zerg	4.1.2	dll	No	2019 Registered	COMPILED + TESTED
XiaoYi	Benchang Zheng	XiaoYi AI Lab	Terran	4.1.2	dll	No	2019 Registered	COMPILED + TESTED
Iron	Igor Dimitrijevic	Independent	Terran	4.1.2	dll		2018 Returning	COMPILED + TESTED
ZZZKBot	Chris Coxe	Independent	Zerg	4.2.0	dll		2018 Returning	COMPILED + TESTED
UAlbertaBot	David Churchill	Memorial University	Random	4.2.0	dll		2018 Returning	COMPILED + TESTED
Stormbreaker	Mingqiang Li	Independent	Terran	4.1.2	dll	Yes	2019 Registered	DISQUALIFIED
Apollo	Apollo Hanl	Independent	Zerg	4.2.0	dll	No	2019 Registered	Did Not Submit
CDBot	Seevan Yang	Independent	Zerg	4.1.2	dll	Yes	2019 Registered	Did Not Submit
DanDanBot	TaeYoung Kim	Independent	Protoss	4.1.2	dll	No	2019 Registered	Did Not Submit
Dragon	Vegard Mella	Independent	Protoss	4.4.0	dll	No	2019 Registered	Did Not Submit
Firefrog	Feng Gao	Independent	Zerg	4.2.0	dll	Yes	2019 Registered	Did Not Submit
KimBot	Taeja Kim	Independent	Terran	3.7.4	dll	No	2019 Registered	Did Not Submit
LetaBot	Martin Rooijackers	Maastricht University	Terran	3.7.4	dll	No	2019 Registered	Did Not Submit
MetaBot	Anderson Tavares	Uni. Fed. do Rio Grande do Sul	Protoss	3.7.4	dll	No	2019 Registered	Withdraw
Murph	Francisco Javier Sacido	UC3M	Protoss	4.4.0	dll/client	No	2019 Registered	Did Not Submit
Ophelia	Jean Chassoul	https://github.com/spacebeam	Zerg	4.1.2	dll	No	2019 Registered	Did Not Submit
CSE	Wei Guo	Independent	Protoss	4.1.2	dll		2018 Returning	Withdraw
LastOrder	Sijia Xu	Bilibili	Zerg	4.2.0	dll+proxy		2018 Returning	Withdraw
SAIDA	Changhyeon Bae	Samsung SDS	Terran	4.1.2	dll		2018 Returning	Withdraw

	Bot Name	Author Name	Affiliation	Race	BWAPI	Type	Status
1	BlueBlueSky	Pengfei Hou	Independent	Protoss	4.1.2	dll	2018 Registered
2	CDBot	Seevan Yang	Independent	Zerg	4.1.2	dll	2018 Registered
3	CherryPi	Gabriel Synnaeve + Team	Facebook AI Research	Zerg	4.2.0	proxy	2018 Registered
4	CSE	Wei Guo	Independent	Protoss	4.1.2	dll	2018 Registered
5	CUNYBot	Bryan Weber	CSI-CUNY	Zerg	4.2.0	dll	2018 Registered
6	DaQin	Lion Gis	Independent	Protoss	4.1.2	dll	2018 Registered
7	Ecgberht	Francisco Javier Sacido	Univ. Carlos III Madrid	Terran	4.2.0	Java	2018 Registered
8	Hellbot	James Hellman	Falmouth University	Protoss	3.7.4	client	2018 Registered
9	KillAll	Zhentao Tang	Independent	Zerg	4.1.2	dll	2018 Registered
10	ISAMind	Fang Gao	Independent	Protoss	4.1.2	dll	2018 Registered
11	LastOrder	Sijia Xu	Bilibili	Zerg	4.2.0	dll+proxy	2018 Registered
12	Locutus	Bruce Nielsen	Independent	Protoss	4.1.2	dll	2018 Registered
13	McRave	Christian McCrave	Independent	Protoss	4.2.0	dll	2018 Registered
14	MetaBot	Anderson Tavares	UFMG	Protoss	3.7.4	dll	2018 Registered
15	Microwave	Micky Holdorf	Independent	Zerg	4.1.2	dll	2018 Registered
16	SAIDA	Changhyeon Bae	Samsung SDS	Terran	4.1.2	dll	2018 Registered
17	Steamhammer	Jay Scott	Independent	Zerg	4.1.2	dll	2018 Registered
18	Tyr	Simon Prins	Independent	Protoss	4.1.2	Java	2018 Registered
19	WillyT	Nico Klausner	Independent	Terran	4.2.0	dll	2018 Registered
20	AILien	Alexander Stumpp	Independent	Zerg	4.2.0	dll	2017 Returning
21	Aiur	Florian Richoux	Université de Nantes	Protoss	3.7.4	dll	2017 Returning
22	Arrakhammer	Anthony Van	Stanford University	Zerg	4.1.2	dll	2017 Returning
23	Iron	Igor Dimitrijevic	Independent	Terran	4.1.2	dll	2017 Returning
24	LetaBot	Martin Rooijackers	University Maastricht	Terran	3.7.4	dll	2017 Returning
25	UAlbertaBot	David Churchill	Memorial University	Random	4.2.0	dll	2017 Returning
26	Ximp	Tomas Vajda	Independent	Protoss	3.7.4	dll	2017 Returning
27	ZZZKBot	Chris Coxe	Independent	Zerg	4.2.0	dll	2017 Returning



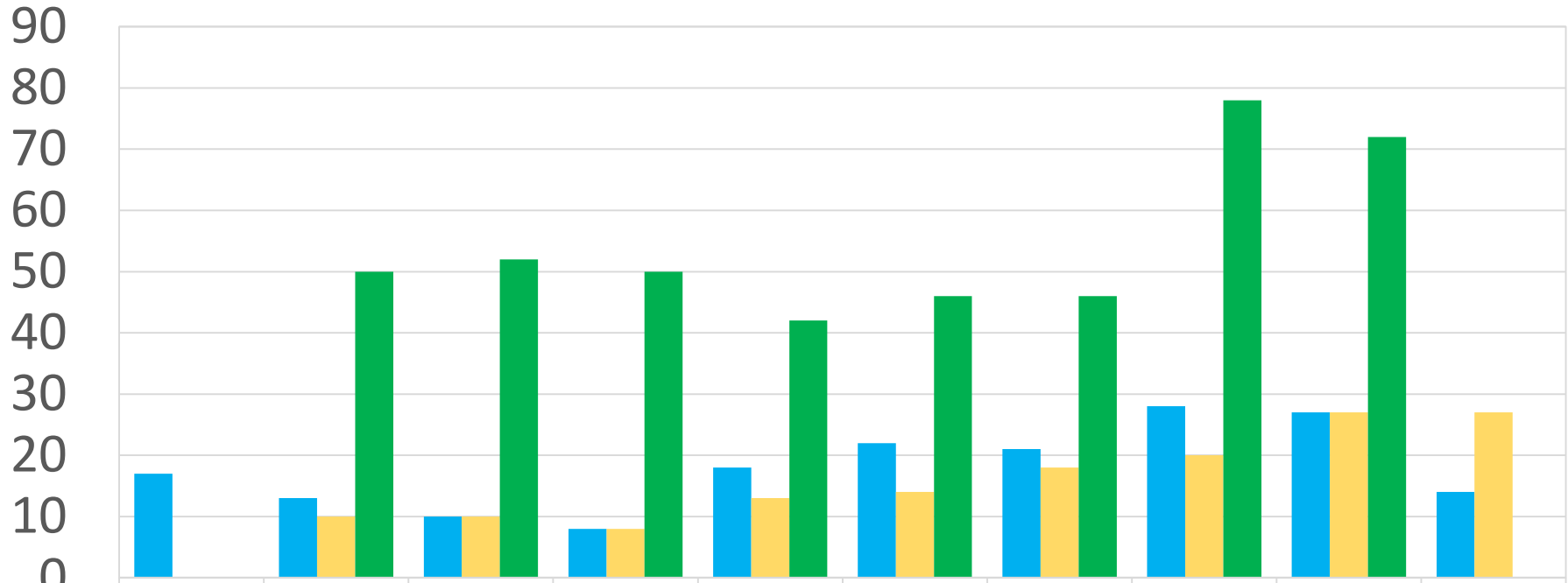




Tournament Statistics

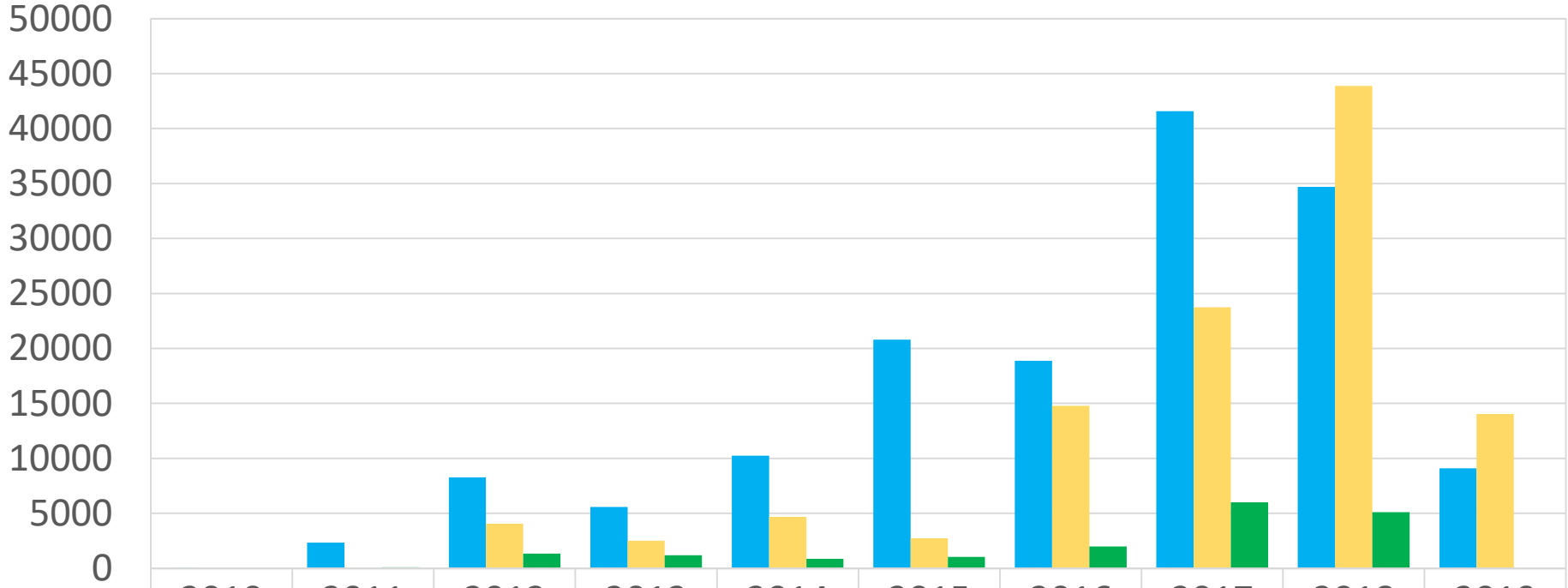
- Played on 12 virtual/real machines
- Tournament ran for ~1 week
- 9090 games played in total
- ~1300 games per bot
- 100 games per bot pairing
- 10 games per pairing per map

Starcraft AI Competitions - Total Entrants



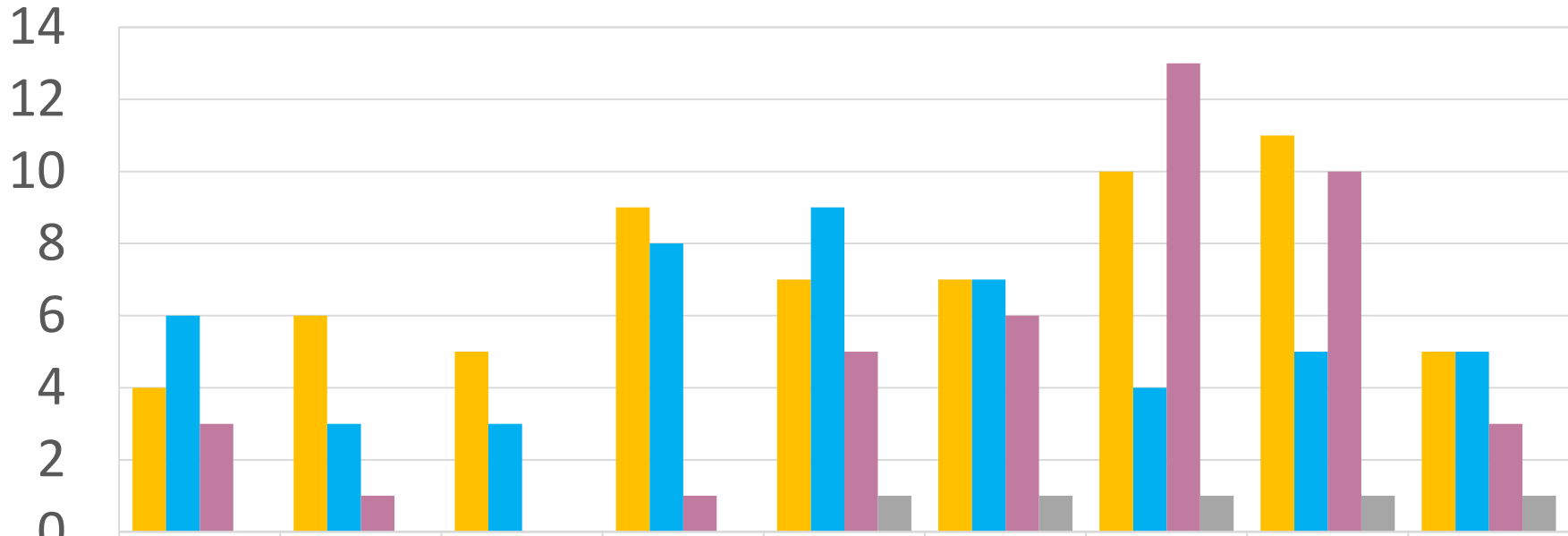
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AIIDE	17	13	10	8	18	22	21	28	27	14
CIG		10	10	8	13	14	18	20	27	27
SSCAIT		50	52	50	42	46	46	78	72	

Starcraft AI Competitions - Total Games Played

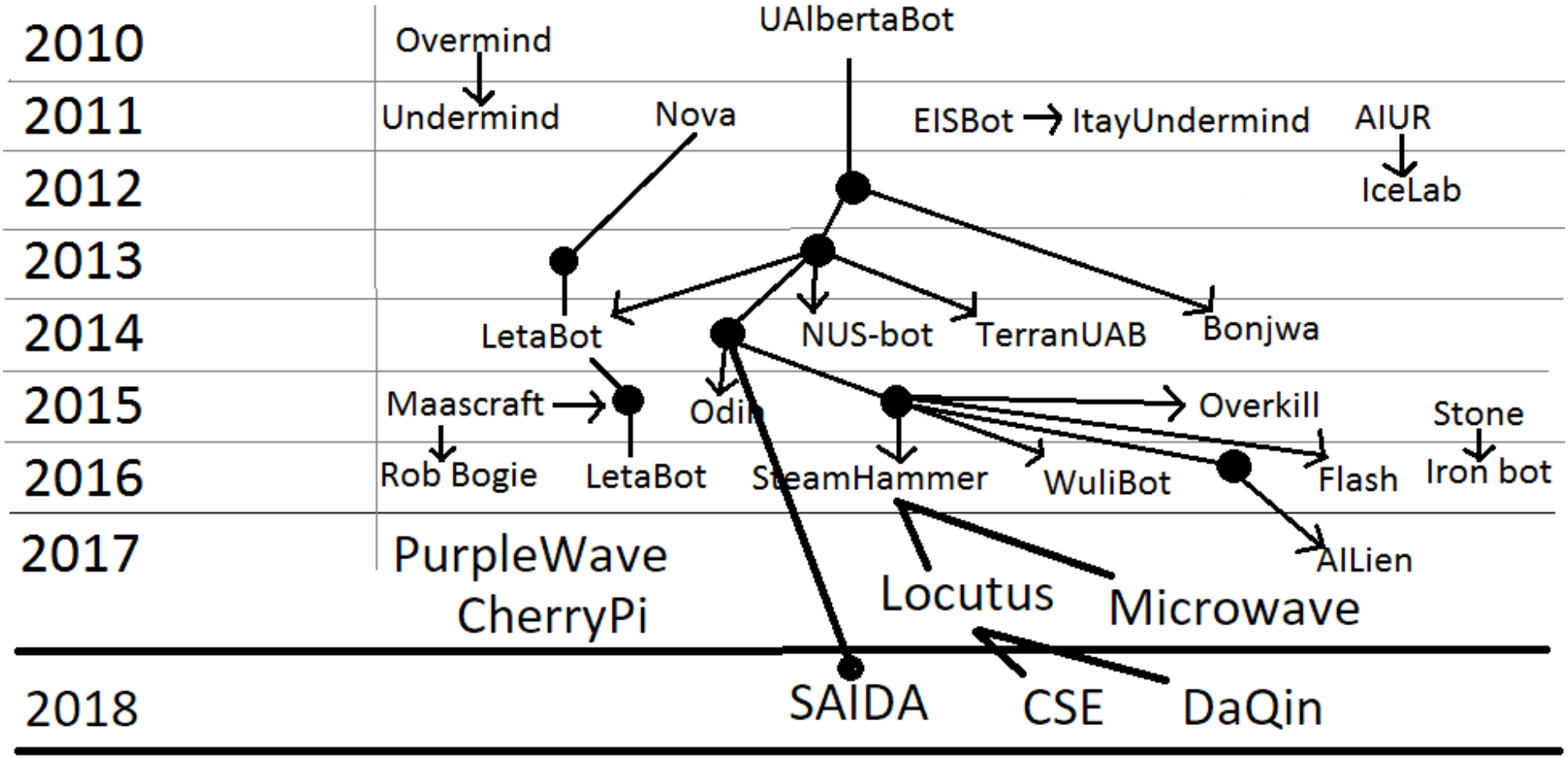


	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AIIDE	70	2340	8279	5579	10251	20788	18882	41580	34694	9090
CIG		40	4050	2500	4680	2730	14787	23750	43875	14027
SSCAIT		100	1326	1190	861	1035	1980	6006	5112	

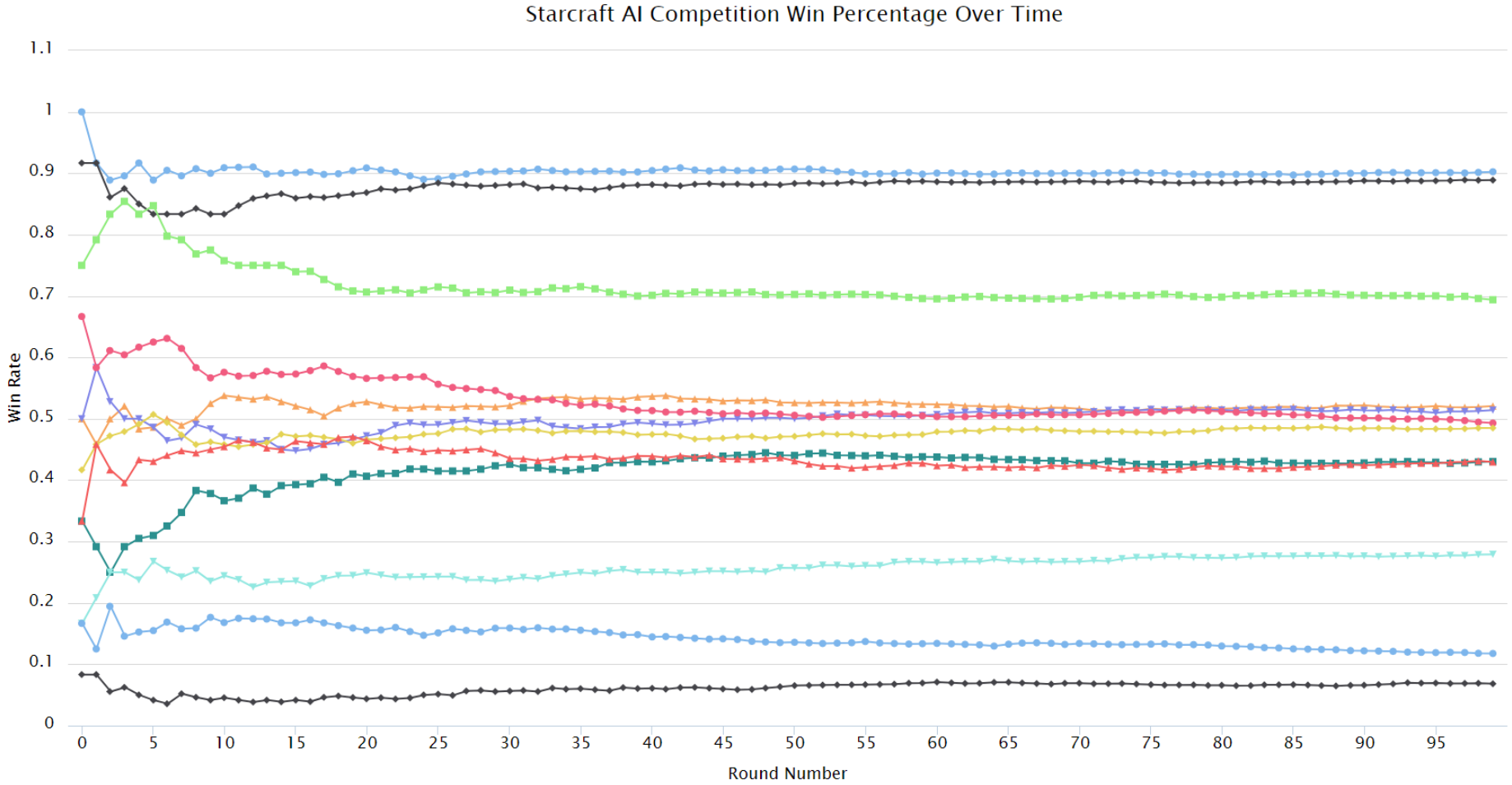
AIIDE Starcraft AI Competition - Race Distribution



	2011	2012	2013	2014	2015	2016	2017	2018	2019
Protoss	4	6	5	9	7	7	10	11	5
Terran	6	3	3	8	9	7	4	5	5
Zerg	3	1	0	1	5	6	13	10	3
Random	0	0	0	0	1	1	1	1	1


2010
2011
2012
2013
2014
2015
2016
2017
2018
Overmind
Undermind
Nova
UAlbertaBot
EISBot
ItayUndermind
AIUR
IceLab
LetaBot
NUS-bot
TerranUAB
Bonjwa
Maascraft
Rob Bogie
LetaBot
Odin
SteamHammer
Overkill
WuliBot
Flash
Stone
Iron bot
AILien
PurpleWave
CherryPi
Locutus
Microwave
SAIDA
CSE
DaQin

RESULTS


Starcraft AI Competition Win Percentage Over Time
Win Rate
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95
Round Number

Rock, Paper, Scissors?

- A beats B, B beats C, C beats A
- Can happen with different strategies
  - Rush beats Expand
  - Expand beats Defend
  - Defend beats Rush
- 2017 Competition:
  - 1 > 2 > 10 > 6 > 3 > 5 > 8 > 9 > 4 > 7 > 1

No Real RPS in 2019

-	052/100	082/100	076/100	093/100	097/100
048/100	-	086/100	071/100	097/100	094/100
018/100	014/100	-	045/100	085/100	081/100
024/100	029/100	055/100	-	052/100	066/100
007/100	003/100	015/100	048/100	-	091/100
003/100	006/100	019/100	034/100	009/100	-

	Bot	Win %	2018
1st			
2nd			
3rd			
4th			
5th			

	Bot	Win %	2018
1st			
2nd			
3rd			
4th			
5th	Iron	52.08	6th

	Bot	Win %	2018
1st			
2nd			
3rd			
4th	BananaBrain	67.67	-
5th	Iron	52.08	6th

	Bot	Win %	2018
1st			
2nd			
3rd	DaQin	69.39	5th
4th	BananaBrain	67.67	-
5th	Iron	52.08	6th

	Bot	Win %	2018
1st			
2nd	PurpleWave	88.89	-
3rd	DaQin	69.39	5th
4th	BananaBrain	67.67	-
5th	Iron	52.08	6th

	Bot	Win %	2018
1st	Locutus	90.24	4th
2nd	PurpleWave	88.89	-
3rd	DaQin	69.39	5th
4th	BananaBrain	67.67	-
5th	Iron	52.08	6th

Bot	Games	Win	Loss	Win %	Avg Game Time	Avg Wall Time	Game Time Limit	Crash	Frame Timeout
Locutus	1199	1082	117	90.24	10:12	1:41	3	0	0
PurpleWave	1197	1064	133	88.89	13:29	5:57	7	0	0
DaQin	1199	832	367	69.39	12:20	2:14	3	0	0
BananaBrain	1200	812	388	67.67	11:36	3:32	2	0	78
Iron	1200	625	575	52.08	14:38	3:26	26	6	5
Microwave	1200	617	583	51.42	10:06	1:54	4	40	9
XiaoYi	1199	591	608	49.29	14:21	3:15	25	0	0
Steamhammer	1198	581	617	48.5	11:31	2:00	1	0	0
ZZZKBot	1199	516	683	43.04	9:32	1:17	3	0	0
McRave	1199	515	684	42.95	11:00	3:53	16	101	346
UAlbertaBot	1193	333	860	27.91	10:13	2:27	12	3	0
AITP	1199	141	1058	11.76	12:18	2:20	5	189	5
BunkerBoxeR	1200	82	1118	6.83	10:07	1:38	35	62	3
Total	**7791**	**7791**	**7791**	**N/A**	**11:39**	**2:44**	**71**	**401**	**446**

PurpleWave

- Author(s): Dan Gant
- 2017: 2nd place by < 1% win rate
- 2018: 2nd place CherryPi (Facebook)
- 2018: 1st place AIST / SSCAIT (PurpleWave)
- 2019: 1st Place CiG / 2nd Place AIIDE
- Protoss Bot

PurpleWave

- PurpleWave plays a fairly complete package of pro-style Protoss strategies. Almost anything that's objectively good and can be executed with the existing micro skills and building placement is in there. There are aggressive strategies, economic strategies, and some delightfully cheesy strategies too.
- It features a graph of strategy selections, like opening build orders paired with mid game transitions and late-game compositions, and learns to assemble the best combinations.

PurpleWave

- Has a general-purpose pathfinding library using A* which is used for lots of different purposes: Threat-aware pathfinding for retreating or Shuttle usage, for detecting wall-ins, andnavigating map obstacles.
- PurpleWave uses potential fields for navigating flying units, and as part of the cost function in the threat-aware pathfinding.
- Most of what it does is rules-based, though usually in flexible ways that I'd hesitate to call it "hard-coded".

Locutus

- Author(s): Bruce Nielson
- Software Engineer, Denmark
- 2018: 4th Place AIIDE
- 2019: 3rd Place CoG

Locutus

- My focus so far has been on the fundamentals, so generally the bot uses macro-heavy strategies using low-tech units. It also has some "cheese" openings, like proxies and drops, that are chosen to try to exploit common weaknesses in bots.

Locutus

- Uses heuristic search for path-finding
- Online learning of opponent strategies
- “Basically everything is based on either the fixed opening build order or rule-based reactions (e.g. enemy has cloak tech -> get mobile detection).”

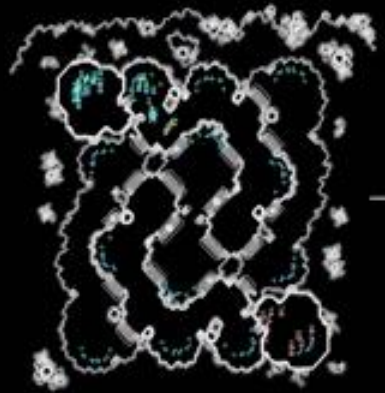
Conclusions

- We saw lots of interest at registration time, but many authors did not submit agents
- Strength of top 2 bots is higher than previous bots in the competition
- Samsung / Facebook pulled did not submit any new entry and withdrew previous
- Previous winner (SAIDA) would place 3rd

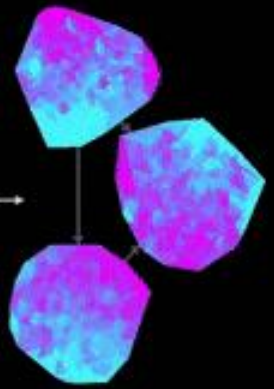

Oh, oh, one more thing
before I forget ...

What About AlphaStar?

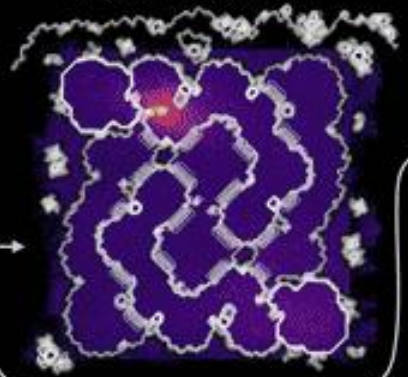
Raw Observations



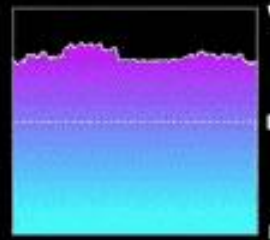
Neural Network Activations



Considered Location



Outcome Prediction



Considered Build/Train

Consider This

- Memorial University
  - 2018/2019 Budget - $369 Million CAD
- Google DeepMind
  - 2018 **Losses** - $761 Million CAD

- Impossible to catch up to their scale

Artificial Intelligence / Machine Learning

Training a single AI model can emit as much carbon as five cars in their lifetimes

Deep learning has a terrible carbon footprint.

by **Karen Hao** Jun 6, 2019

Thank You!

Email: dave.Churchill@gmail.com

www.StarCraftAICompetition.com