

Online game bot detection based on party-play log analysis

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Introduction

- Recently, the number of cheating in online game environments increased.
-> Security has become important issue.
(Save information of both publishers and customers)

- In this research, they proposed a bot detection framework based on user behavior analysis, especially on party play.

- Before explanation of research, let's see some example of bot detection.

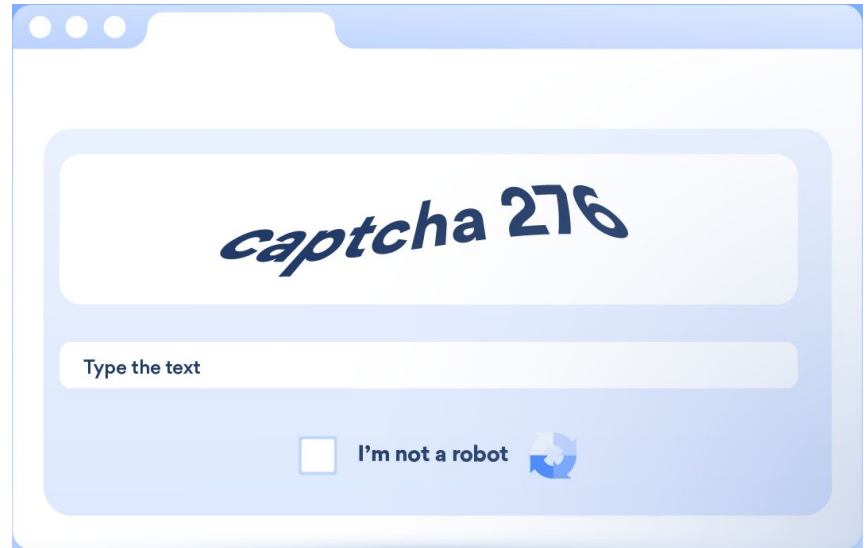
Previous bot detection

Recent research on bot detection.

Category	Adapted method	Definition/key papers	Key idea	Merits/demerits
Client side detection	CAPTCHA analysis	Detection method with challenge-response test [6,7]	- Challenge-response method	- Merit: high speed - Demerit: reducing immersion of players in online game Low feasibility
Network side detection	Traffic analysis	Detection method based on network traffic analysis [8,9]	- Command packets timing analysis - Traffic explosiveness analysis - Networks response analysis - Data length analysis - Traffic interval time analysis	- Merit: high utilization of the other algorithms like decision tree - Demerit: low accuracy rate
Server side detection	User behavior analysis	Detection method based on user behavior pattern in game play [10-15]	- Idle time analysis - Social connection analysis (chatting, trade)	- Merit: high accuracy rate, high detection rate, high availability
	Moving path analysis	Detection method based on patterns and zones of moving path analysis [16-18]	- Coordinate analysis - Zone analysis	- Merit: high feasibility - Demerit: low accuracy rate
	Human observation proofs (HOP) analysis	Detection method with keyboard and mouse input patterns analysis [19,20]	- User inputs observation - Windows event sequence analysis	- Merit: high accuracy rate - Demerit: low feasibility

CHAPTHA analysis (Client)

- This is a type of bot detection.
- By asking question such as easy for human player, but difficult for bot.
- merit: speedy
demerit: reducing immersion



Traffic analysis (Network)

- In traffic analysis, we see the timing of command packet, network response speed, length of data, traffic interval time, etc...
- In another research, it is found that bot send less information than human, and exhibit regular and fast packet arrivals patterns.

User behavior analysis (Server)

- It is based on the idea which there are difference between human behavior and bot one.

For example:

Human are not able to access for so long time, but bots are able to.

Research - User behavior analysis for bot detection -

- They focused on especially the party play.

Their Hypothesis:

If the party member are human, they cooperate for some purpose.

– to clear difficult quests, do the limited events, etc...

But, if the party member are bots, we can expect that they may repeat hunting, collection for their purpose is collecting item or experience value.

– they make party for make efficient in collecting items.

Also, bots party tend to make a party consist of 2 member, one collect or hunt and other defend member.

Research - User behavior analysis for bot detection -

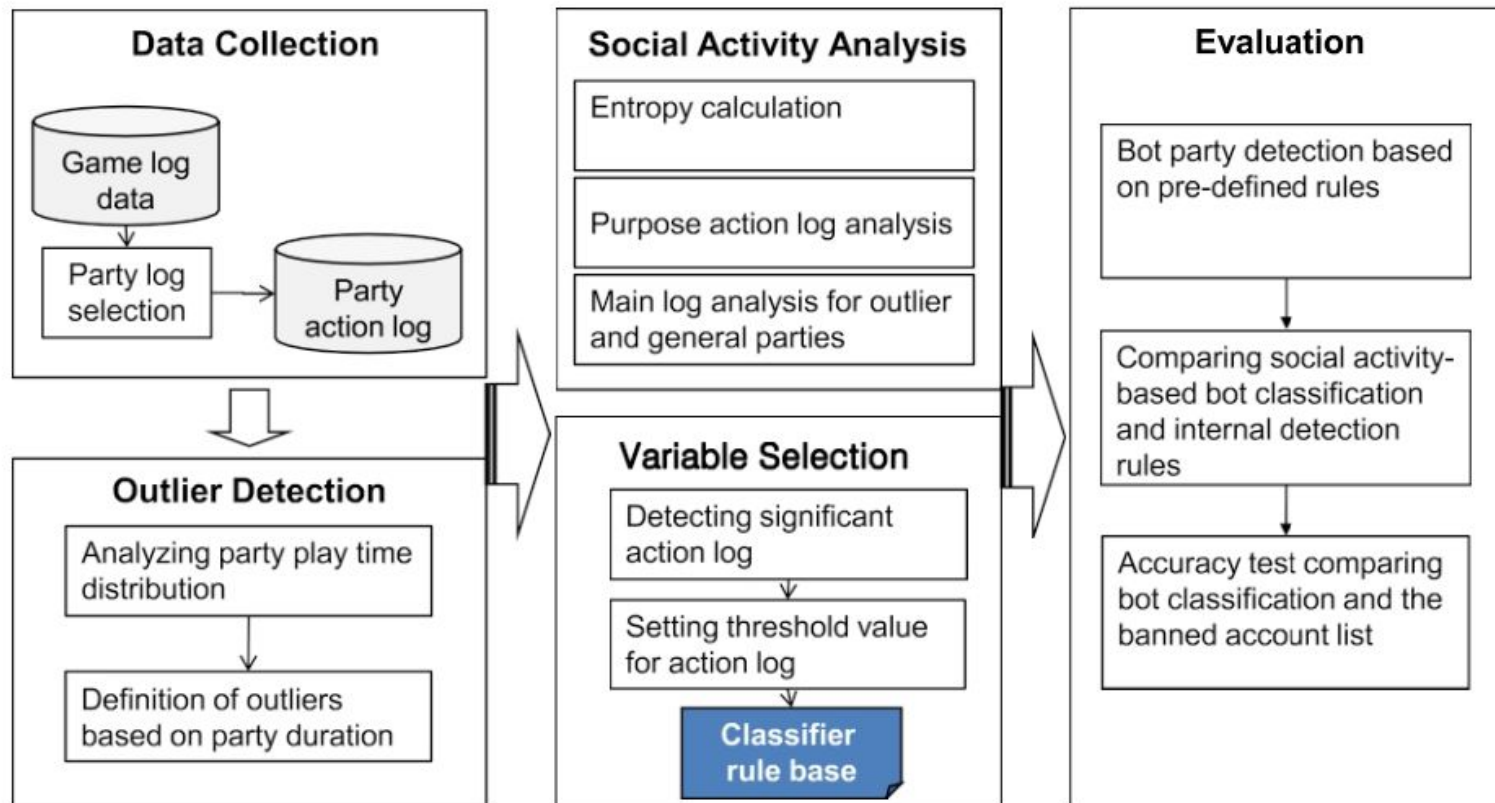
- For validating their hypothesis, they identify the major actions taken by parties, then characterize the details of action logs based on following two parameter.
 1. The proportion of an action over total actions
 2. The ranking of an action log.
- Based on above two parameter, they made rule base. By adopting it to the action log of party, they tried to specify bots.

Research - User behavior analysis for bot detection -

- They adopted these rule base into AION online, which is the type of MMORPG.
- After they detected bots, then evaluate the spec of this rules by cross-checking the bots identified by their method and the confirmed list of bots provided by the company of AION

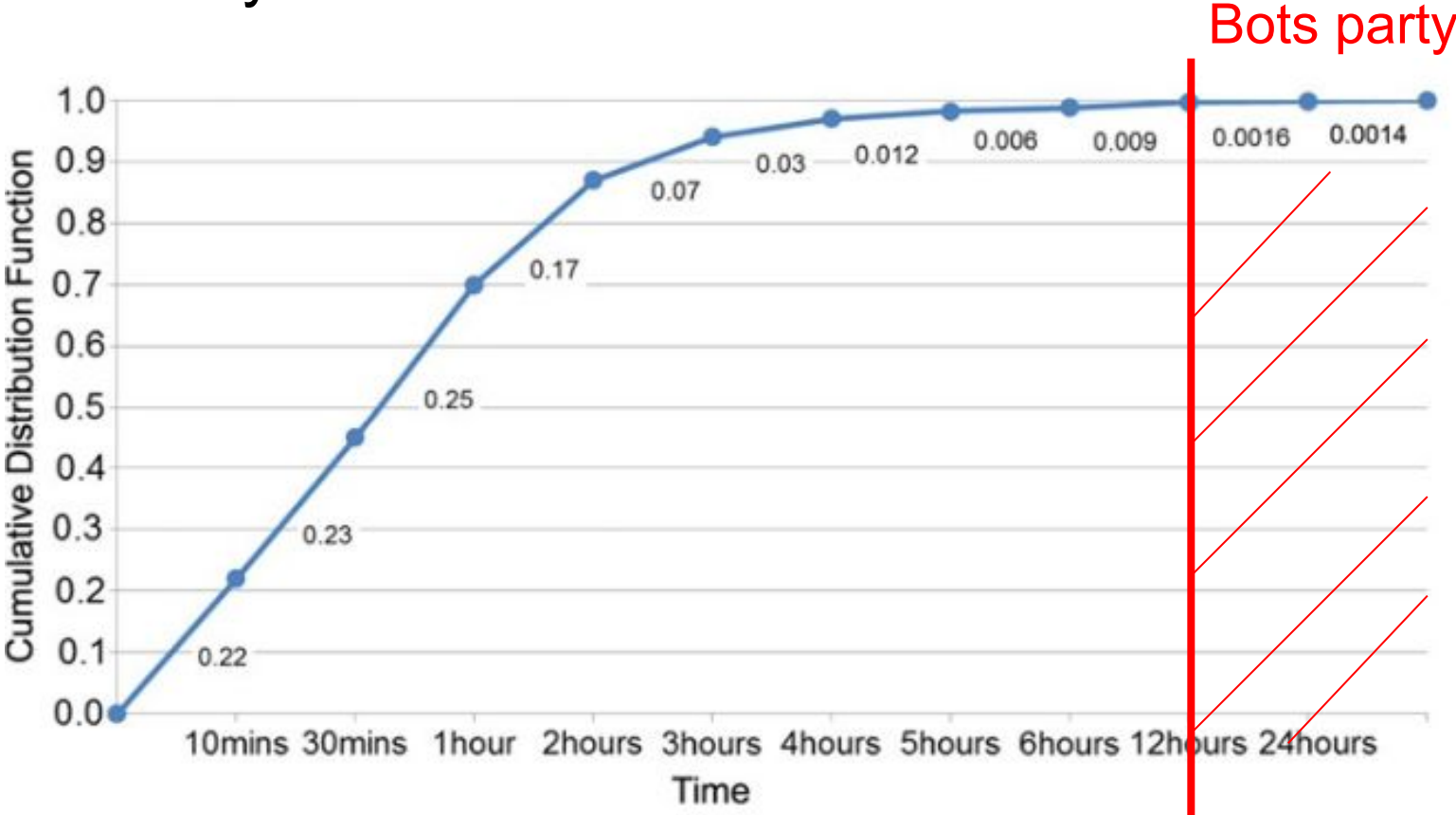


The flow of bot detection

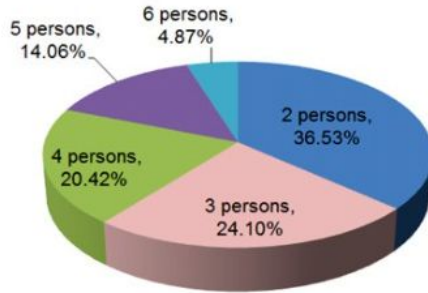


Result (1) analysis

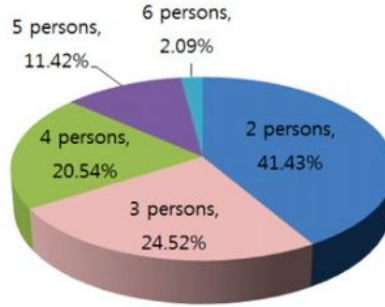
Result -analysis



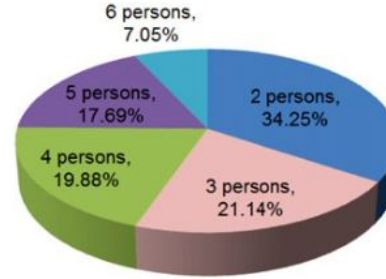
Result -analysis



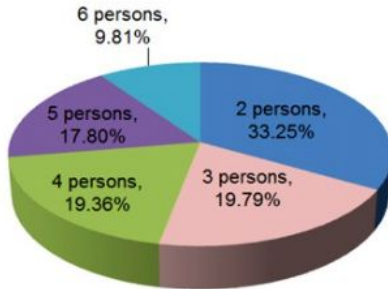
(a) total



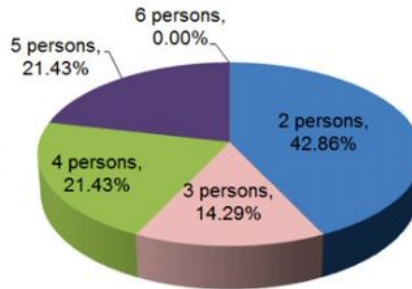
(b) t+10m



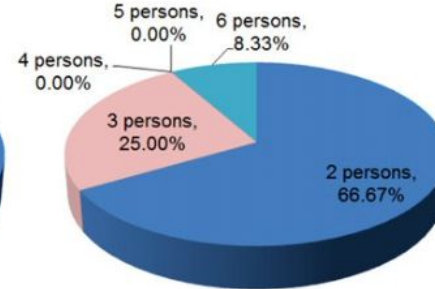
(c) t+3h



(d) t+6h



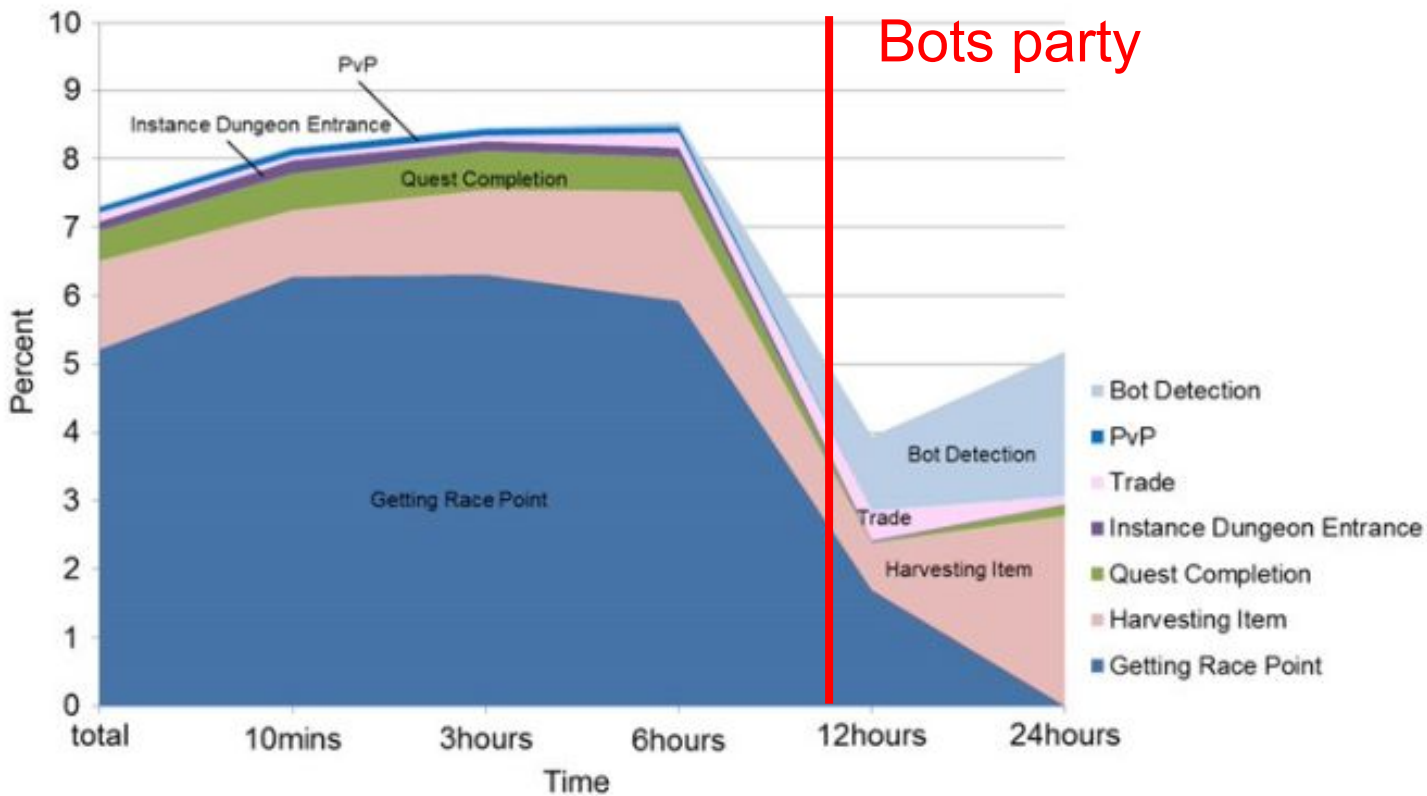
(e) t+12h



(f) t+24h



Result -analysis



Result -analysis

They also calculated the entropy of action log distribution by following formula:
(entropy indicates the diversity of action, if entropy is higher, they take more kind of actions.)

$$- \sum_{i=1}^n P_i \log_2 P_i$$

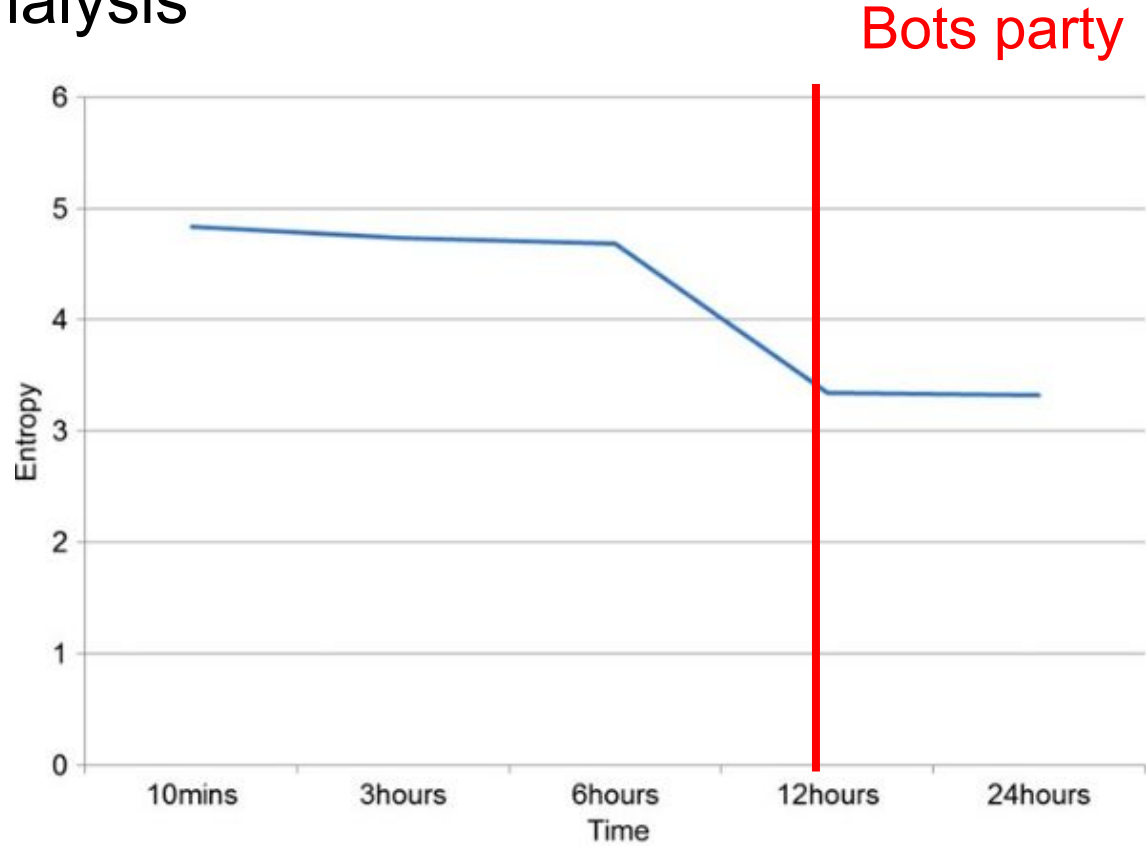
n : the number of logs (for log $i = 1, 2, 3, \dots, n$).

P_i : the probability of the occurrence of a log i .

Entropy according to party duration.

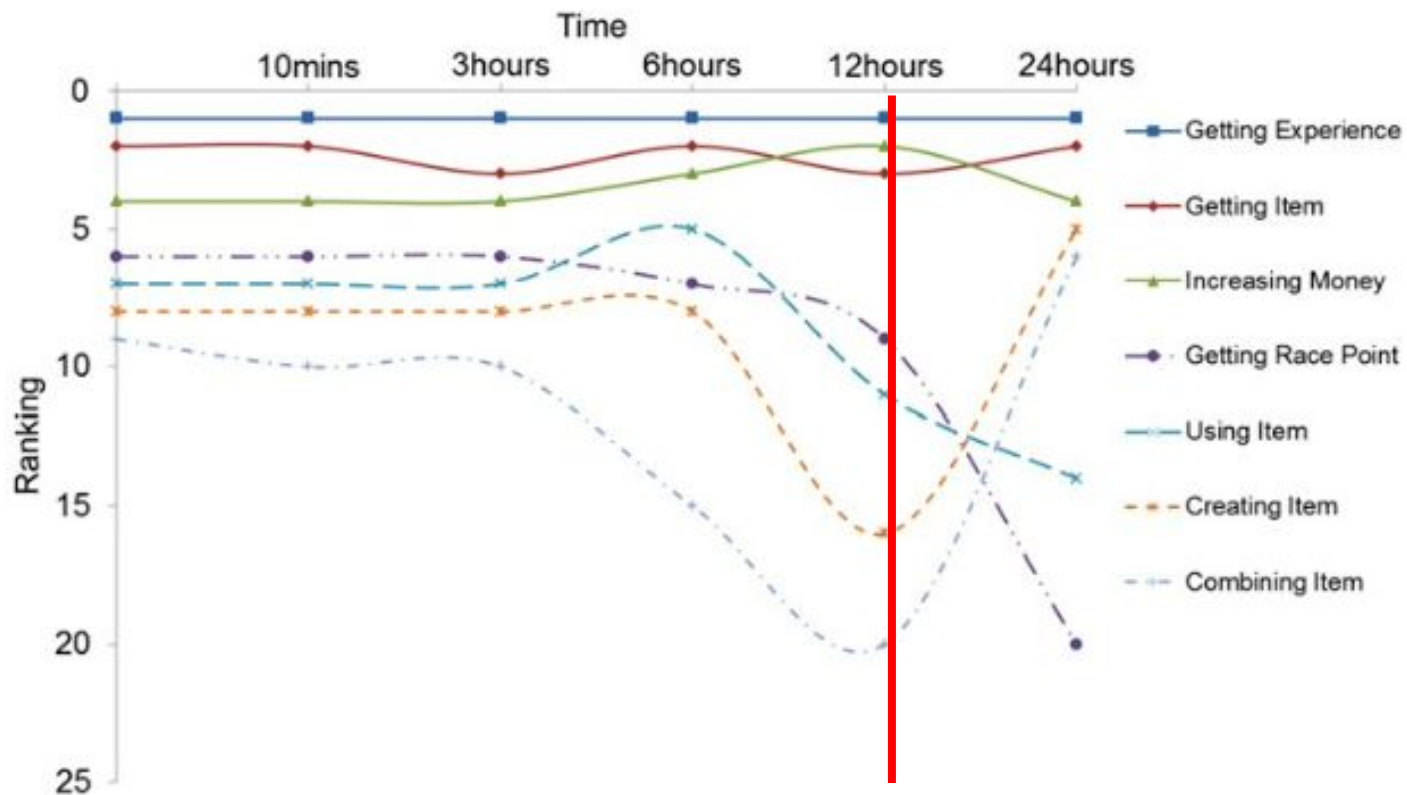
	Total	t + 10 m	t+3 h	t+6 h	t + 12 h	t + 24 h
Entropy	4.779	4.835	4.731	4.679	3.338	3.322

Result -analysis

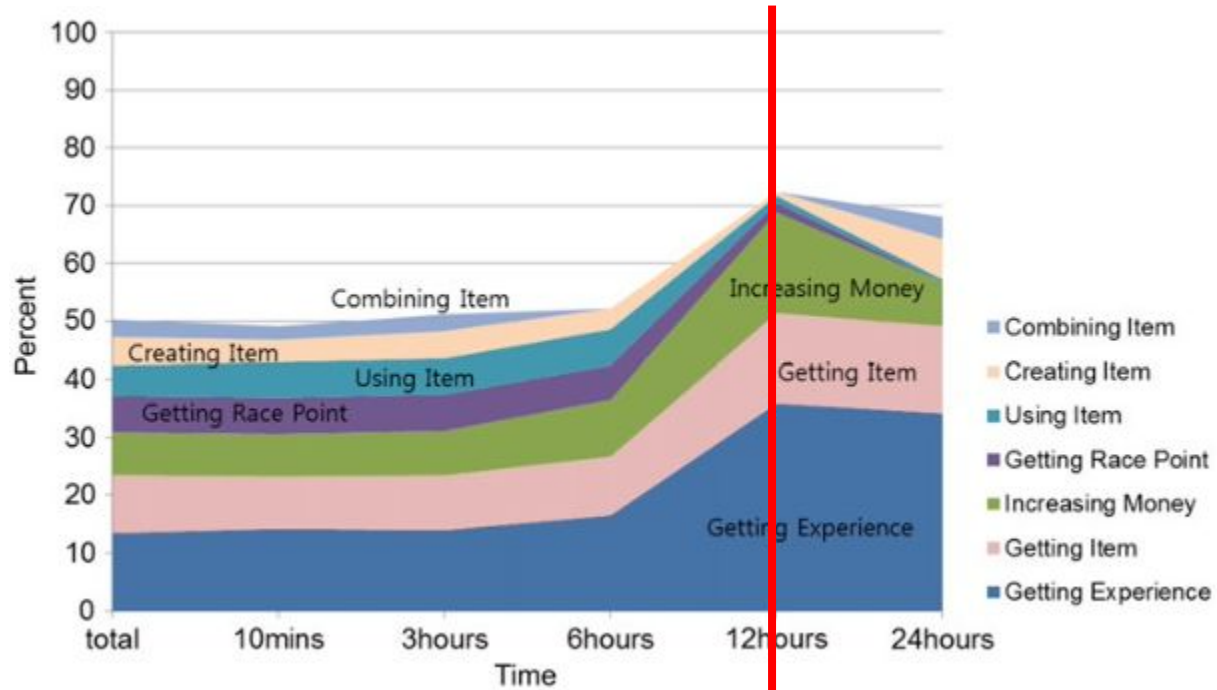


Result -analysis

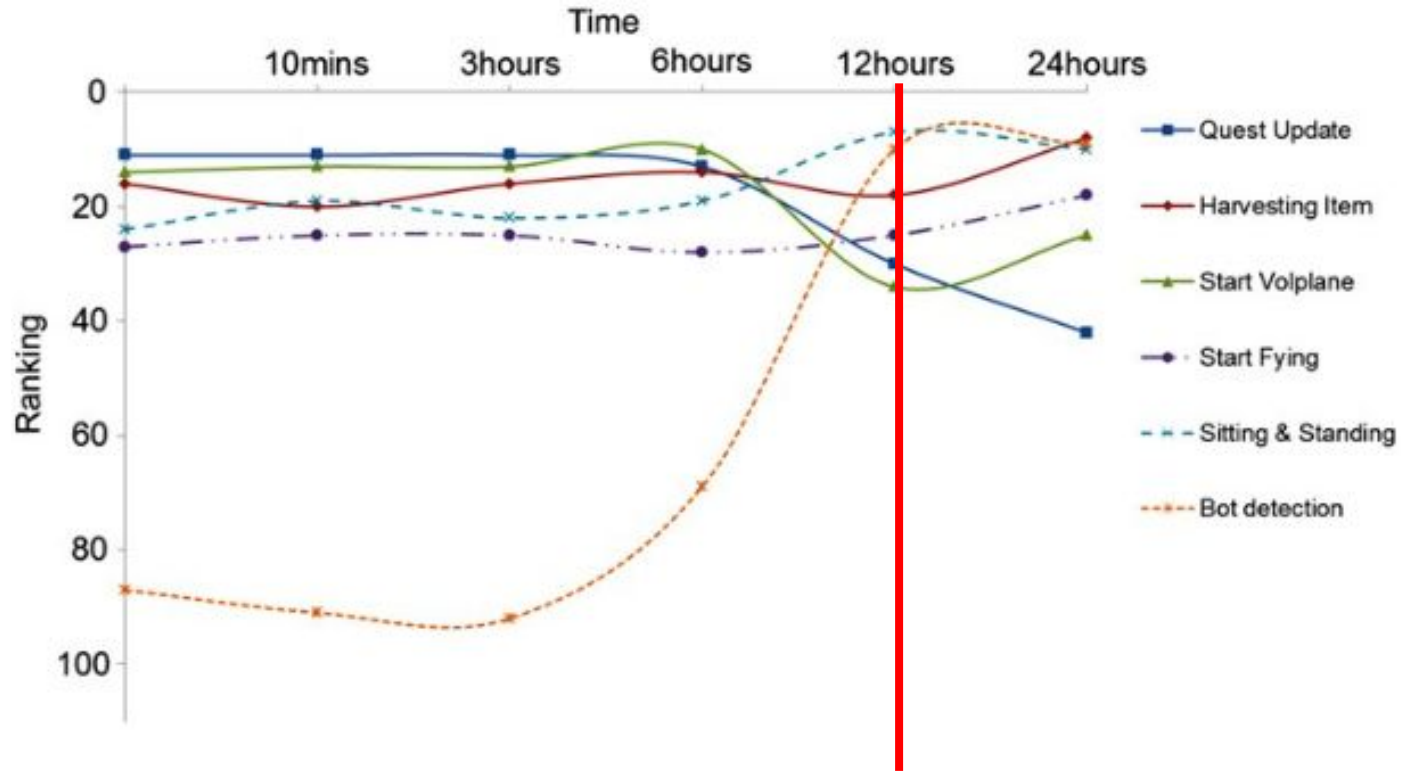
Bots party



Result -analysis



Result -analysis



From analysis...

- They found that these characters that for distinguish human party and bots party. So, using these characters, they made a rule base of detecting.
- By using this rule, they detected bots from all of users.

Bot detection rule.

Rule-base

Getting experience log $\geq 34\%$ and getting race point
log $\leq 1.69\%$ and sitting log \leq top 10 and using item
log $\leq 1.19\%$ and quest completion log $\leq 0.16\%$
and start volplane log \geq top 34 and party member = 2 and party duration ≥ 600 s

Result -detection

Bot detection rate and accuracy rate comparison.

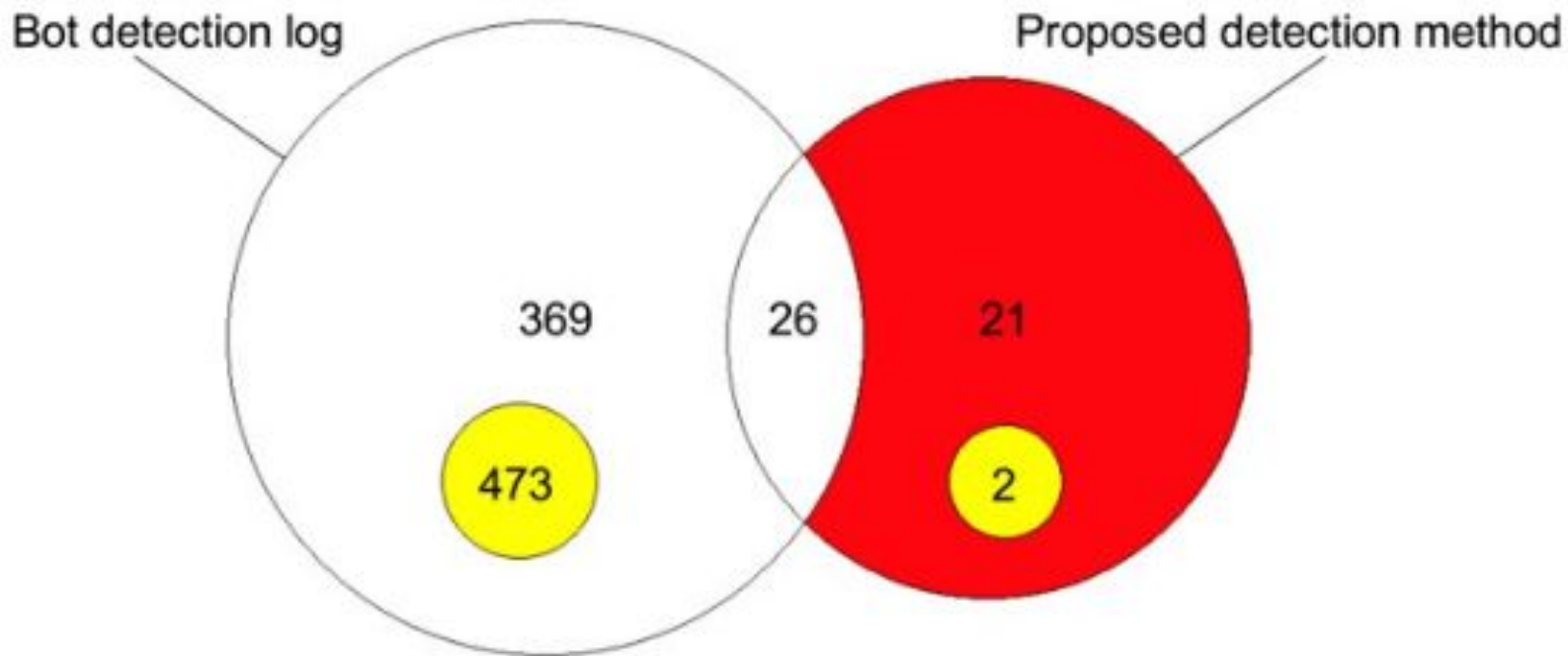
Proposed detection method	Bot detection log	Banned account list
49	26	47

Proposed detection method : The number of user who were detected as bot by a rule base.

Bot detection log : The number of user who have detection code among detected user.

Banned account list : The number of user who were banned from AION server.
($\hat{=}$ the number of bots.)

Result -detectoin



Result -accuracy rate

Accuracy rate of bot detection.

Method	Accuracy rate
Party log (7 days)	95.92% (47/49)
VPN/PPTP log (30 days)	35.83% (929/2593)
Harvest log (1 day)	54.17% (13/24)
Chat log (9 days)	67.56% (25/37)
Trade log (30 days)	38.97% (265/680)

Conclusion

- We can detect bots by using a method on party play.
- By using this method, we can avoid the issues of another methods such as conflicting with other software in Anti-Cheat system.
- We got some characteristics of bots.
 - They make a 2 persons party, and one does hunting or harvesting, other defends it.
 - Their purpose of party is getting items as much as possible. So, their action is different from humans.

Conclusion

- They adopted proposed framework to AION's game log.
- By using charts and statistic analysis, they got some characteristics of bots and made rule base.
Based on this rule base, they got to detect game bots.
- Finally, they evaluated the accuracy of bot detection. In the banned account lists, the accuracy rate of bots detection is up to about 96%.