

Analysis of Game bot's Behavioral Characteristics in Social Interaction Networks of MMORPG

Seong Hoon Jeong, Ah Reum Kang, Huy Kang Kim

Graduate School of Information Security, Korea University, {seonghoon, armk, cenda}@korea.ac.kr



Introduction

MMORPG and Game Bot

- In MMORPG, users can interact with other users by doing various actions such as party-play, combat, trading, etc.
- Game Bots are automated AI programs executing repetitive tasks.

What Game Bots do

- Game Bots obtain illegal benefits through gold-farming and real-money trading without corresponding efforts.

Hypothesis: Game Bots mainly do repetitive tasks, their interaction patterns are different from Human's.

Research Gaps

- Previous studies of Game Bot detection mainly aimed distinguishing Game Bot's play patterns from Human's.
- Social interaction-based approach can characterize differences between Game Bots and Human users.

AION

- World-wide popular online game serviced by NCSOFT

Data period	April 9 th ~ July 5 th of 2010
# of Players	96,806
# of Humans	82,428
# of Game Bots	14,378

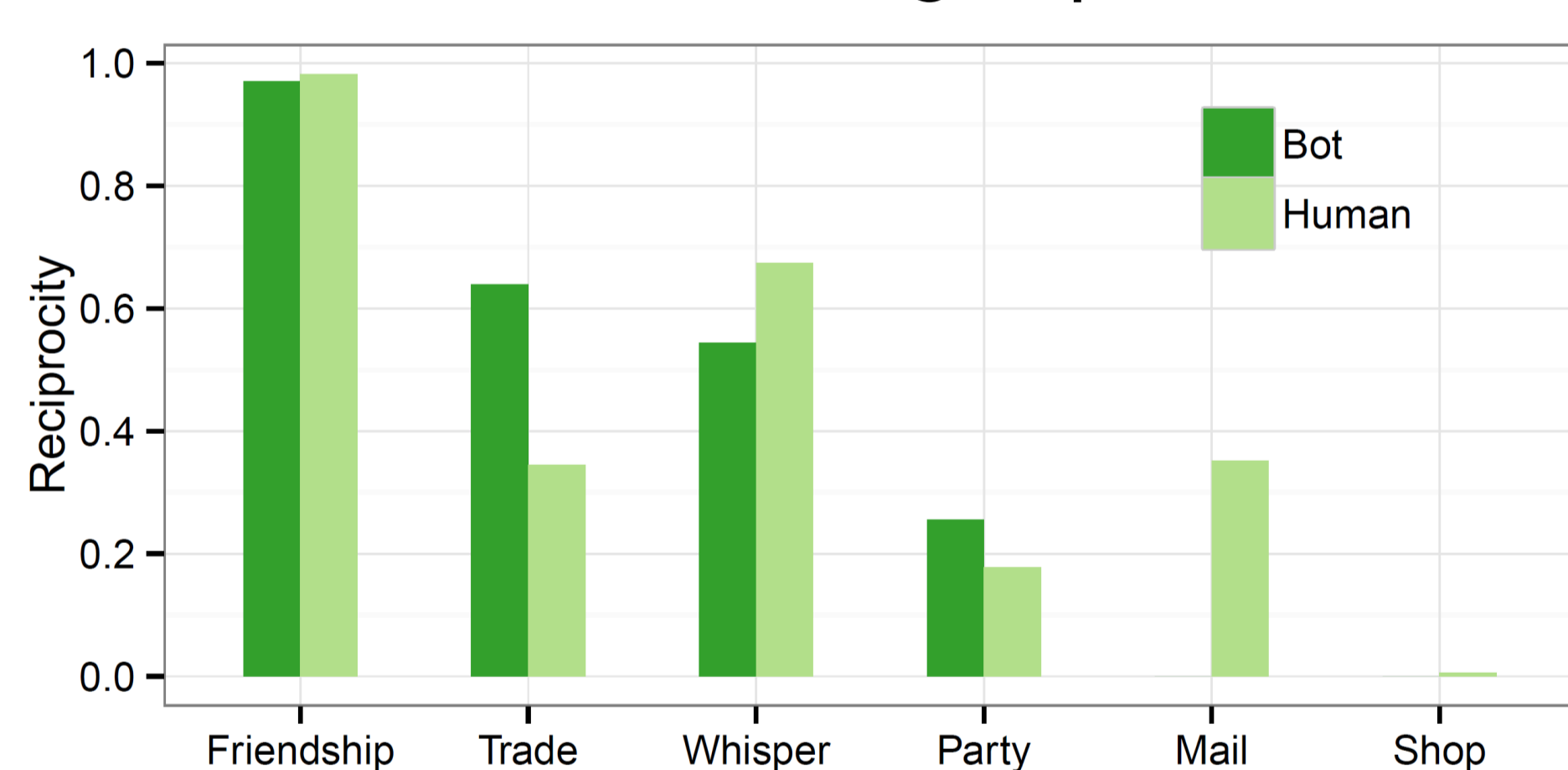
Experiment Results

Summary of the six basic network characteristics

Group	Party		Friendship		Trade		Whisper		Mail		Shop	
	# of nodes	# of edges	# of nodes	# of edges	# of nodes	# of edges	# of nodes	# of edges	# of nodes	# of edges	# of nodes	# of edges
Bot-All	21,511	108,575	12,889	22,906	19,710	42,094	11,970	36,362	42,553	103,442	2	1
Bot-Bot	4,063	14,223	1,717	3,803	7,120	19,137	1,919	5,328	0	0	2	1
H.-All	44,460	962,287	30,266	194,372	41,160	189,433	21,373	290,837	38,934	92,833	7,410	19,283
H.-H.	40,345	864,160	26,829	175,332	35,957	168,047	17,813	252,775	38,934	92,833	6,160	12,656
All-All	46,896	1,070,862	30,917	217,278	46,560	231,527	21,771	327,199	56,663	196,275	7,411	19,284

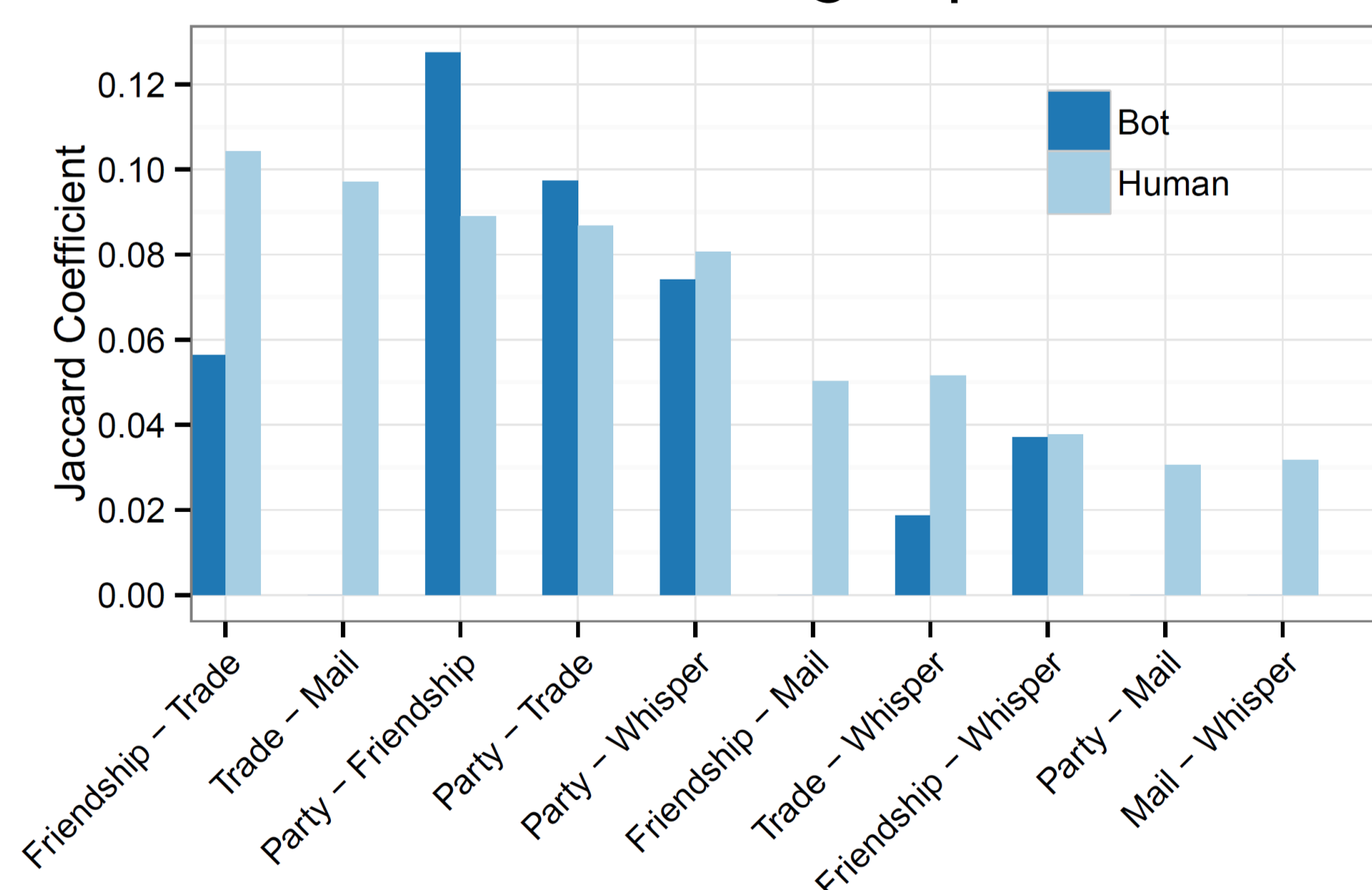
The reciprocity of edges in each interaction network

- Bot-Bot and Human-Human group



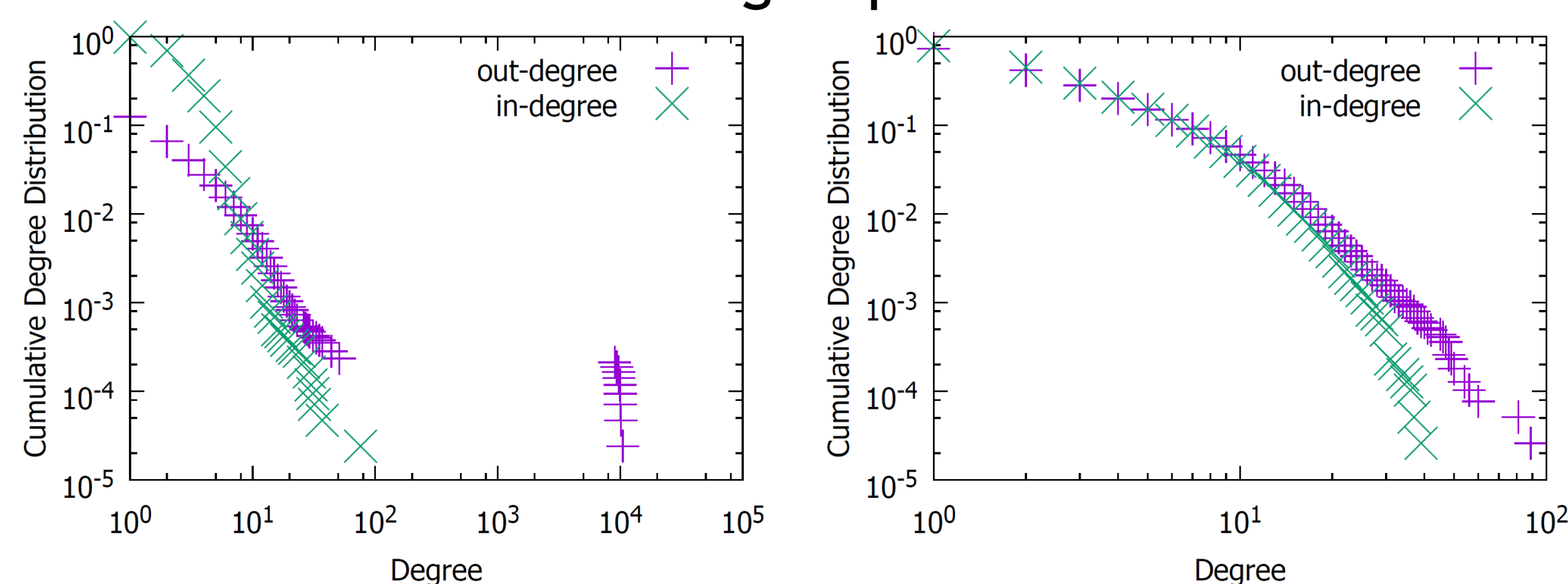
Pairwise network overlaps (Jaccard similarity)

- Bot-Bot and Human-Human group



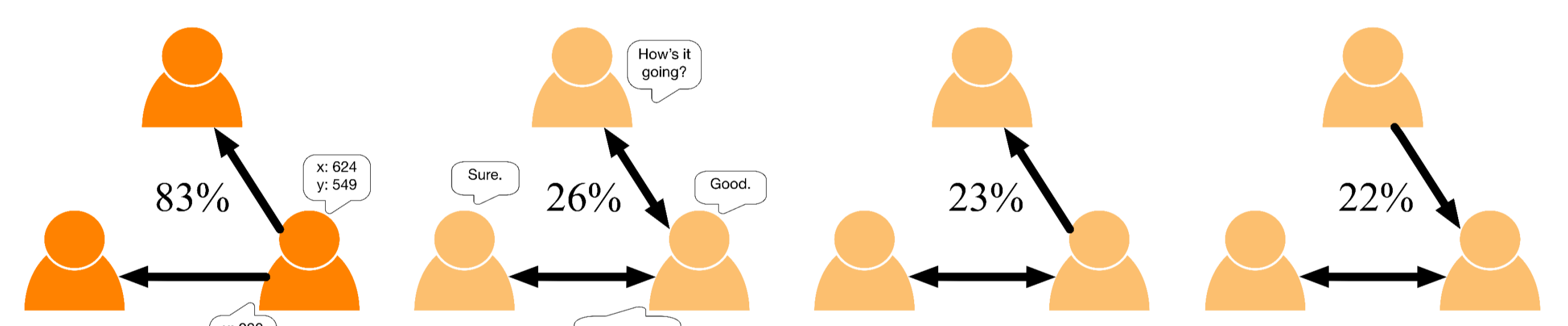
The in- and out-degree distribution

- Bot-All and Human-All group in Mail Network



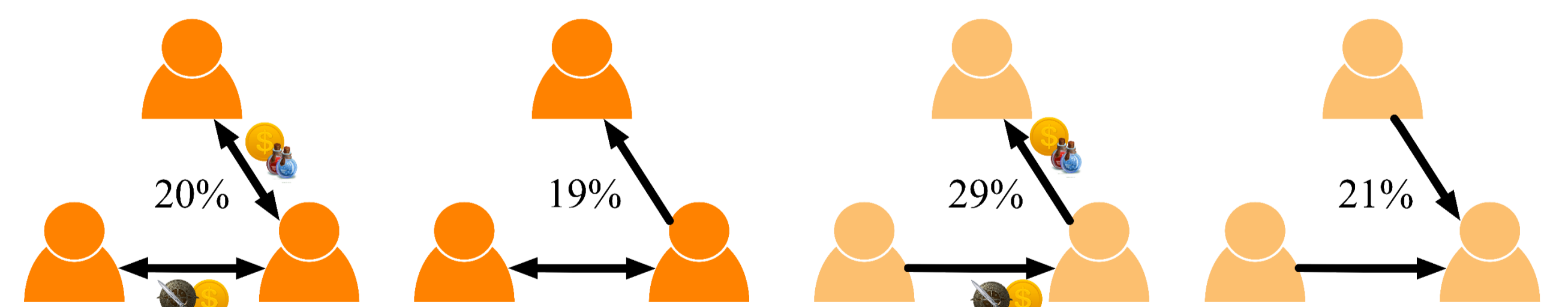
The fraction of each motif type

- Whisper network



- Game Bots send other Game Bots coordinates to hunt targets.
- Humans talk each other via a private message channel.

- Trade network



- Game Bots trade with other Game Bots to gather game money and items.
- Humans often give free money and items.

Key Findings

- Bot-Bot group only has social interactions in Party, Friendship, Trade, and Whisper network.
 - Game Bots are more reciprocal in Party and Trade networks.
- We found that Game Bots execute repetitive tasks associated with gold-farming and real-money trading.
 - Bot-Bot group has link overlaps in six networks.