

## Appendix

1. Abbreviation List
2. List of Security-related Keywords
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### Abbreviation List

Abbreviation	Replaced with
ad/AD/ads/ADS	advertisement/advertisements
pls/plz/Pls/Plz/plzz	please
info	information
id/ID	identify, identity
asap	as soon as possible
ap/aps	app/apps
pic/pics	picture/pictures
fav	favourite
msg	message
cam	camera
fab	fabulous
coz/cos/becoz	because
ins	instagram
fyi	for your information
thx/thz	thanks
ez	easy
u	you
ur	your
jst/jus	just
frnds	friends
bt	but
b4	before
tbh	to be honest
kinda	kind of
nt	not
notif	notification
acc	account
min/mins	minute/minutes
sec/secs	second/seconds

4IR	Fourth Industrial Revolution
to	too
nic	nice
&	and
cud	could
wud	would
b	be
r	are
luv	love
gud	good
omg	oh,my god

## List of Security-related keywords

crash	bloatware	tamper	privacy	leak	permission
confidentiality	breach	spam	advertisement	scam	steal
security	phish	spyware	malware	virus	hack
adware	scammer	freeze	risk	stutter	flaw
danger	hacker	attack	invade	invasion	hijack
hijacker	damage	spy	swipe	bombard	intrude
adfree	cheat	riskware	scareware	junkware	safety
violate	violation	fraud	spammer	thief	destory
unsafety	overcharge	crapware	worm	bundleware	vulnerability
pirateware	harm	breacher	protection	ransomware	protect
malspam	malvertising	cybersecurity	cyberattack	antivirus	trojan
spoofing	smishing	cryptojacking	intrusion	leakage	

## Semantic Patterns

Semantic Pattern	Misbehavior	Aspect	Opinion
VB[nsubjpass-NN[compound-NN]]	VB	compound-NN+nsubjpass-NN	
VB[nsubjpass-NN]	VB	nsubjpass-NN	
VB[nsubj-NN(app),dobj-NN[compound-NN,conj-NN]]	VB	compound-NN+dobj-NN conj-NN	
VB[nsubj-NN(app),dobj-NN[nmod-NN[case-IN]]]	VB	nmod-NN	
VB[nsubj-NN(app),dobj-NN[compound-NN]]	VB	compound-NN+dobj-NN	
VB[nsubj-NN(app),dobj-NN[conj-NN]]	VB	dobj-NN conj-NN	
VB[nsubj-NN(app),dobj-NN]	VB	dobj-NN	

VB[nsubj-NN(app),nmod-NN[case-IN]]	VB	nmod-NN	
VB[nsubj-PRP,dobj-NN[compound-NN,conj-NN]]	VB	compound-NN+dobj-NN conj-NN	
VB[nsubj-PRP,dobj-NN[amod-JJ]]	VB	dobj-NN	amod-JJ
VB[nsubj-PRP,dobj-NN[compound-NN]]	VB	compound-NN+dobj-NN	
VB[nsubj-PRP,dobj-NN[conj-NN]]	VB	dobj-NN conj-NN	
VB[nsubj-PRP,dobj-NN[nmod-NN[case-IN]]]	VB	nmod-NN	
VB[nsubj-PRP,dobj-NN]	VB	dobj-NN	
VB[nsubj-PRP,nmod-NN]	VB	nmod-NN	
VB[dobj-NN[compound-NN]]	VB	compound-NN+dobj-NN	
VB[dobj-NN[amod-JJ]]	VB	dobj-NN	amod-JJ
VB[dobj-NN[conj-NN]]	VB	dobj-NN conj-NN	
VB[dobj-NN]	VB	dobj-NN	
VB[(time lot times)]	VB		
VB[nsubj-NN,advmod-RB]	VB	nsubj-NN	
VB[nsubj-NN[compound-NN],advmod-RB]	VB	compound-NN+nsubj-NN	
VB[nsubj-NN[nmod-NN[case-IN]]]	VB	nmod-NN	
VB[nsubj-NN[compound-NN]]	VB	compound-NN+nsubj-NN	
VB[nsubj-NN[conj-NN]]	VB	nsubj-NN conj-NN	
VB[nsubj-NN]	VB	nsubj-NN	
VB[nsubj-NN(app)]	VB		
VB[nmod-NN[case-IN]]	VB	nmod-NN	
VB(has,have,had)[dobj-NN[amod-JJ[conj-JJ]]]	VB	dobj-NN	amod-JJ conj-JJ
VB(has,have,had)[dobj-NN[amod-JJ]]	VB	dobj-NN	amod-JJ
VB(has,have,had)[dobj-NN[nmod-NN[case-IN]]]	VB	nmod-NN	
VB(like,love,enjoy)[dobj-NN,neg-RB]		dobj-NN	neg-RB+VB
VB(hate,dislike)[dobj-NN,nsubj-PRP]		dobj-NN	VB
VB(hate,dislike)[dobj-PRP]			VB
VB(hate,dislike)[dobj-NN(app),nsubj-PRP]			VB
VB(hate,dislike)[ccomp-VB[dobj-NN]]	ccomp-VB	dobj-NN	VB
VB[nsubj-NN,conj-VB]	VB conj-VB	nsubj-NN	
VB[nsubj-NN(app),conj-VB]	VB conj-VB		
VB[nsubj-PRP,conj-VB]	VB conj-VB		

VB[nsubj-PRP,ccomp-VB[dojb-NN,conj-VB]]	ccomp-VB conj-VB	dojb-NN	
VB[nsubj-PRP,ccomp-VB[dojb-NN]]	ccomp-VB	dojb-NN	
VB[nsubj-PRP,ccomp-NN]		ccomp-NN	
VB[neg-RB,dojb-NN]	neg-RB+VB	dojb-NN	
VB[nsubj-PRP,advmod-RB]	VB		
VB[conj-VB[dojb-NN]]	VB conj-VB	dojb-NN	
VB[conj-VB]	VB conj-VB		
VB[nsubj-NN,xcomp-VB]	xcomp-VB	nsubj-NN	
VB[nsubj-PRP,xcomp-VB[conj-VB]]	xcomp-VB conj-VB		
VB[nsubj-PRP,xcomp-VB[dojb-NN]]	xcomp-VB	dojb-NN	
VB[nsubj-NN(app),xcomp-VB[dojb-NN]]	xcomp-VB	dojb-NN	
VB[nsubj-VB(crashing)]	nsubj-VB		
VB[nsubj-PRP,xcomp-VB]	xcomp-VB		
VB[nsubj-NN(app),xcomp-VB]	xcomp-VB		
VB[nsubj-PRP,xcomp-VB,conj-JJ[nsubj-PRP,cop-VB]]	xcomp-VB		conj-JJ
VB[nsubj-NN,xcomp-JJ]	xcomp-JJ	nsubj-NN	
VB[nsubj-PRP,xcomp-JJ]	xcomp-JJ		
VB[nsubj-NN(app),dojb-NN,conj-VB[dojb-NN]]	VB conj-VB	dojb-NN dojb-NN	
VB[nsubj-NN(app),xcomp-VB[dojb-NN],conj-VB[dojb-NN]]	xcomp-VB conj-VB	dojb-NN dojb-NN	
VB[nsubj-NN,dojb-PRP,xcomp-VB[dojb-NN]]	xcomp-VB	dojb-NN	
VB[nsubj-PRP,dojb-NN,conj-VB]	VB conj-VB	dojb-NN	
VB[nsubj-PRP,dojb-NN,conj-VB[dojb-NN]]	VB conj-VB	dojb-NN dojb-NN	
VB[nsubj-PRP,dojb-NN,advmod-RB]	VB	dojb-NN	
VB[dojb-NN,conj-JJ[nsubj-PRP,cop-VB]]	VB	dojb-NN	conj-JJ
VB[xcomp-VB[dojb-NN[amod-JJ]]	xcomp-VB	dojb-NN	amod-JJ
VB[xcomp-VB[dojb-NN]]	xcomp-VB	dojb-NN	
VB[xcomp-VB[nsubj-NN]]	xcomp	nsubj-NN	
VB[advmod-RB]	VB		
NN[nmod-NN[case-IN]]		nmod-NN	
NN[conj-NN]		NN conj-NN	
NN[dep-DT]		NN	

NN[amod-JJ]		NN	amod-JJ
NN[dep-RB]		NN	
NN[compound-NN]		compound-NN+NN	
NN[dep-DT,compound-NN]		compound-NN+NN	
NN(crashes)[dep-RB]	NN		
NN[(many much)]		NN	
NN[nsbj-NN(app),cop-VB]		NN	
NN[nsbj-PRP,cop-VB]		NN	
NN[nsbj-PRP,cop-VB,amod-JJ]		NN	amod-JJ
NN[amod-JJ,compound-NN]		compound-NN+NN	amod-JJ
NN[nmod-NN,amod-JJ]		NN	amod-JJ
JJ[nsbj-NN(app),neg-RB]			neg-RB+JJ
JJ[nsbj-NN(app)]			JJ
JJ[nsbj-NN[compound-NN]]		compound-NN+nsbj-NN	JJ
JJ[nsbj-NN,conj-JJ]		nsbj-NN	JJ conj-JJ
JJ[nsbj-NN]		nsbj-NN	JJ
JJ[conj-JJ]			JJ conj-JJ
JJ[nsbj-PRP,neg-RB]			neg-RB+JJ
JJ[nsbj-PRP]			JJ
JJ[nsbj-PRP,nmod-NN[case-IN]]		nmod-NN	JJ
JJ[nmod-NN[case-IN]]		nmod-NN	
JJ[advmod-RB]			JJ
JJ[nsbj-PRP,conj-VB[dojb-NN]]	conj-VB	dojb-NN	JJ
JJ[nsbj-PRP,conj-VB[nmod-NN]]	conj-VB	nmod-NN	JJ
JJ[dep-NN(app)]			JJ
RB[dep-JJ]			RB+dep-JJ