## Zero-Shot Learning for Requirements Classification: An Exploratory Study (Appendices)

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Table 1: Overall classification results for  $Task\ FR/NFR$  for each ZSL Classifier, which is a combination of a specific LM and a specific label configuration. Bold values indicate the best results for a specific ZSL classifier; underlined values indicate the overall best performance across all the classifiers; values in italics indicate a possibly misleading performance, related to the imbalance of F1 between classes.

ZSL Classifier	wP	wR	wF1
Sbert + FR_A	0.52	0.43	0.35
$Sbert + FR\_B$	0.60	0.46	0.37
$Sbert + FR\_C$	0.64	0.48	0.40
$Sbert + FR\_D$	0.54	0.55	0.54
$Sbert + FR\_E$	0.71	0.66	0.66
$Sbert + FR\_F$	0.69	0.64	0.64
$AllMini  +  FR\_A$	0.56	0.55	0.55
AllMini + FR_B	0.53	0.48	0.46
AllMini + FR_C	0.54	0.45	0.39
$AllMini + FR\_D$	0.63	0.59	0.59
AllMini + FR_E	0.60	0.53	0.51
AllMini + FR_F	0.66	0.56	0.53
$Bert4RE + FR\_A$	0.35	0.59	0.44
$Bert4RE + FR\_B$	0.52	0.56	0.51
$Bert4RE + FR\_C$	0.58	0.56	0.57
$Bert4RE + FR\_D$	0.59	0.56	0.56
$Bert4RE + FR\_E$	0.59	0.52	0.51
$\_Bert4RE + FR\_F$	0.57	0.47	0.42
$SObert  +  FR\_A$	0.35	0.59	0.44
$SObert + FR\_B$	0.55	0.59	0.51
${\bf SObert+FR\_C}$	0.58	0.59	0.58
$SObert  +  FR\_D$	0.53	0.58	0.48
$SObert + FR\_E$	0.60	0.56	0.56
$SObert + FR\_F$	0.60	0.55	0.54

Table 2: Label configurations for the remaining NFR classes for Task NFR, binary classification case (continued to table for Table 6 in the paper).

Label Abbr.	Label Configuration	NFR Label	"Other" Label
Performance			
$PE\_A$	Original 1	"performance"	"not about performance"
PE $B$	Expert curated	"periodic execution or efficacy performance"	"not about periodic execution or efficacy performance"
$PE^{-}C$	Word Embedding	throughput, reliability, scalability, responsiveness, efficiency,	"not about throughput, reliability, scalability, responsiveness,
	(selected from top 20 words)	workload, benchmark, latency, speed, improvement, or accuracy"	efficiency, workload, benchmark, latency, speed, improvement,
	(selected from top 20 words)	workload, bellemment, meetey, speed, improvement, or decidedy	or accuracy"
PE D	Word Embedding	throughput, reliability, scalability, responsiveness, efficiency,	"usability, security, operational, look & feel, legal, fault & tolerance,
12_2	(selected from top 20 words)	workload, benchmark, latency, speed, improvement, or accuracy"	maintainability, scalability, availability, or portability
	+ Original 2	workload, benefiniark, latericy, speed, improvement, or accuracy	maintainability, scalability, availability, or portability
PE $E$	Word Embedding	throughput, reliability, scalability, responsiveness, efficiency,	"usability, security, operational, look & feel, legal, fault & tolerance,
1 L_L	(selected from top 50 words)	workload, benchmark, latency, speed, improvement, accuracy,	maintainability, scalability, availability, or portability"
	+ Original 2	achieve, tuning, bottleneck, better, high, optimize, effectiveness,	maintainability, scalability, availability, or portability
	+ Original 2	low, enhances, reducing, incressed, quality, faster, or degrades"	
0		low, enhances, reducing, incresaed, quanty, faster, or degrades	
Operational O A	Original 1	"operational"	"not about operational"
O_A O B		working, running, connecting, interfacing, or operative environment	not about operational not about working, running, connecting, interfacing,
<i>U_B</i>	Expert curated	working, running, connecting, interfacing, or operative environment	
0.0	W 15 1 10		or operative environment"
$o\_c$	Word Embedding	"environmental, organizational, coordination, systemic, or logistics"	"not about environmental, organizational, coordination,
	(selected from top 20 words)		systemic, or logistics"
$O\_D$	Word Embedding	"environmental, organizational, coordination, systemic, or logistics"	"usability, security, performance, look & feel, legal, fault & tolerance,
	(selected from top 20 words)		maintainability, scalability, availability, or portability"
	+ Original 2		
$O\_E$	Word Embedding	"environmental, organizational, coordination, systemic, logistics,	"usability, security, performance, look & feel, legal, fault & tolerance,
	(selected from top 50 words)	coordination, or automation"	maintainability, scalability, availability, or portability"
	+ Original 2		
Look & feel			
$LF\_A$	Original 1	"Look feel"	"not about Look feel"
$LF\_B$	Expert curated	"appearance, interface, look feel"	"not about appearance, interface, look feel"
$LF\_C$	Word Embedding	"graphical, gui, ui, widget, interaction, habit, prefer, comfortable, friendly,	" not about graphical, gui, ui, widget, interaction, habit, prefer,
	(selected from top 20 words)	feeling, experience, or familiar"	comfortable, friendly, feeling, experience, or familiar"
$LF\_D$	Word Embedding	"graphical, gui, ui, widget, interaction, habit, prefer, comfortable, friendly,	"usability, security, operational, performance, fault & tolerance,
	(selected from top 20 words)	feeling, experience, or familiar"	legal, maintainability, scalability, availability, or portability"
	+ Original 2		
$LF\_E$	Word Embedding	"graphical, gui, ui, widget, interaction, habit, prefer, comfortable, friendly,	"usability, security, operational, performance, fault & tolerance,
	(selected from top 50 words)	feeling, experience, familiar, desire, customize, intent, disability,	legal, maintainability, scalability, availability, or portability"
	+ Original 2	or impression"	
Legal		•	
$L\_A$	Original 1	'legal'	"not about legal"
$L\_B$	Expert curated	"legal, law, or rules"	"not about legal, law, or rules"
$L^{-}C$	Word Embedding	"liability, litigation, jurisdiction, regulation, copyright, legislation,	"not about liability, litigation, jurisdiction, regulation, copyright,
	(selected from top 20 words)	enforcement, governmental, directive, civil, right, patentability,	legislation, enforcement, governmental, directive, civil, right,
		claim, violate, infringement, or counsel"	patentability, claim, violate, infringement, or counsel"
L $D$	Word Embedding	liability, litigation, jurisdiction, regulation, copyright, legislation,	"usability, security, operational, performance, look & feel,
	(selected from top 20 words)	enforcement, governmental, directive, civil, right, patentability,	fault & tolerance, maintainability, scalability, availability,
	+ Original 2	claim, violate, infringement, or counsel"	or portability"
L $E$	Word Embedding	liability, litigation, jurisdiction, regulation, copyright, legislation,	"usability, security, operational, performance, look & feel,
<i></i>	(selected from top 50 words)	enforcement, governmental, directive, civil, right, patentability,	fault & tolerance, maintainability, scalability, availability,
		claim, violate, infringement, counsel, holder, dispute, illegal, judicial,	or portability"
	+ Original 2		or portability
	+ Original 2	ruling, agreement, ownership, comply, authority, law, accountability, abuse, intellectual, obligation, invention, court, ethical, concern, or policy*	or portability

Table 2: Continued

Label Abbr.	Label Configuration	NFR Label	"Other" Label
Fault tolerance			
FT_A	Original 1	"fault tolerance"	"not about fault tolerance"
$FT\_B$	Expert curated	"system recovery fault tolerance"	"not about system recovery fault tolerance"
$FT\_C$	Word Embedding (selected from top 20 words)	"tolerance, failure, tolerant, by zantine, deadlock, exploiting, reliability, isolation, fault, guarantee, or dependable'	*not about tolerance, failure, tolerant, byzantine, deadlock, exploiting, reliability, isolation, fault, guarantee, dependable, countermeasure, resilience, defensive, corruption, weakness, malfunction, robustness, or stability*
FT_D	Word Embedding (selected from top 20 words) + Original 2	$\label{eq:continuous} {\rm ^tolerance,failure,tolerant,byzantine,deadlock,exploiting,reliability,isolation,fault,guarantee,ordependable^*}$	"usability, security, operational, performance, look & feel, legal, maintainability, scalability, availability, or portability "
$FT\_E$	Word Embedding (selected from top 50 words) + Original 2	"tolerance, failure, tolerant, byzantine, deadlock, exploiting, reliability, isolation, fault, guarantee, dependable, countermeasure, resilience, defensive, corruption, weakness, malfunction, robustness, or stability"	$^{*}$ usability, security, operational, performance, look & feel, legal, maintainability, scalability, availability, or portability $^{*}$
Maintainability			
$MN\_A$	Original 1	"maintainability"	"not about maintainability"
$MN\_B$	Expert curated	"maintaining, fixing, running or updating"	"not about maintaining, fixing, running or updating"
$MN\_C$	Word Embedding (selected from top 20 words)	"adapta bility, effectiveness, agility, preventive, or dependability"	"not about adaptability, effectiveness, agility, preventive, or dependability"
$MN\_D$	Word Embedding (selected from top 20 words) + Original 2	${\rm `adaptability, effectiveness, agility, preventive, or dependability'}$	"usability, security, operational, performance, look & feel, legal, fault & tolerance, scalability, availability, or portability"
MN_E	Word Embedding (selected from top 50 words) + Original 2	*adaptability, effectiveness, agility, preventive, dependability, correcting, reuse, defect, mitigation, validated, resilience, achievable, remedy, assessing, or maintaining*	*usability, security, operational, performance, look & feel, legal, fault & tolerance, scalability, availability, or portability *
Scalability	- v		
SC_A	Original 1	"scalability"	"not about scalability"
$SC\_B$	Expert curated	"scalable, increasable or developable"	"not about scalable, increasable or developable"
$SC\_C$	Word Embedding (selected from top 20 words)	"flexibility, workload, efficiency, or optimize"	"not about flexibility, workload, efficiency, or optimize"
$SC\_D$	Word Embedding (selected from top 20 words) + Original 2	'flexibility, workload, efficiency, or optimize'	"usability, security, operational, performance, look & feel, legal, fault & tolerance, maintainability, availability, or portability"
SC_E	Word Embedding (selected from top 50 words) + Original 2	"flexibility, workload, efficiency, optimize, caching, improvement, robust, overhead, adaptability, scalable, or increased"	"usability, security, operational, performance, look & feel, legal, fault & tolerance, maintainability, availability, or portability"
Availability			
$A\_A$	Original 1	"availability"	"not about availability"
$A\_B$	Expert curated	"avaliable or timely achievable"	"not about avaliable or timely achievable"
$A\_C$	Word Embedding (selected from top 20 words)	"reliability, dependability, resilience"	"not about reliability, dependability, resilience"
$A\_D$	Word Embedding (selected from top 20 words) + Original 2	${\it `reliability, dependability, resilience'}$	"usability, security, operational, performance, look & feel, legal, fault & tolerance, maintainability, scalability, or portability"
A_E	Word Embedding (selected from top 50 words) + Original 2	$^*$ reliability, dependability, resilience, flexibility, accountability, ensur, disruption, timely, or standby $^*$	*usability, security, operational, performance, look & feel, legal, fault & tolerance, maintainability, scalability, or portability *

Table 3: Label configurations for all the NFR classes for the multi-class and multi-label classification sub-tasks in Task NFR (cf. Table 7 in the paper)

Label Abbr.	Label Configuration	List of Labels
$MultiNFR\_A$	Original	['usability', 'security', 'performance', 'operational', 'look & feel', 'legal', 'fault tolerance', 'maintainability', scalability' availability'
		["instructive, easy, helpful, useful, learnable, explainable, affordable, intuitive, or understandable",
		"security, authorization, or protection", "periodic execution or efficacy performance",
$MultiNFR\_B$	Expert curated	'working, running, connecting, interfacing, or operative environment',
		"appearance, interface, look & feel", "legal, law, or rules", "system recovery & fault tolerance",
		"maintaining, fixing, running or updating", "scalable, increasable or developable", "avaliable or timely achievable"]
		[*accessibility, aesthetic, contextual, experience, satisfaction, HCI, UX, questionnaire, ease, or ergonomics",
		'vulnerability, securing. protecting, protection, cybersecurity, assurance, cyber, countermeasure, threat,
		privacy, authentication, prevention, or confidentiality", "throughput, reliability, scalability, responsiveness,
		efficiency, workload, benchmark, latency, speed, improvement, or accuracy", "environmental, organizational,
MultiNFR C	Word Embedding	coordination, systemic, or logistics", "graphical, gui, ui, widget, interaction, habit, prefer, comfortable,
Manual 11_C	(selected from top 20 words)	friendly, feeling, experience, or familiar, "liability, litigation, jurisdiction, regulation, copyright, legislation,
		enforcement, governmental, directive, civil, right, patentability, claim, violate, infringement, or counsel,
		"tolerance, failure, tolerant, byzantine, deadlock, exploiting, reliability, isolation, fault, guarantee, or dependable",
		"adaptability, effectiveness, agility, preventive, or dependability", "flexibility, workload, efficiency, or optimize",
		"reliability, dependability, resilience"
		[*accessibility, aesthetic, contextual, experience, satisfaction, HCI, UX, questionnaire, ease,
		ergonomics, designer, evaluate, multimodal, practitioner, prototyping, preference, personalization,
		suitability, focus, clarity, responsiveness, judgement, feel, or helpful", "vulnerability, security,
		protection, cybersecurity, assurance, countermeasure, threat, privacy, authentication, prevention,
		confidentiality, trusted, intrusion, compromise, safety, insecure, defensive, breach, proactive, tampering,
		penetration, policy, phishing, vulnerable, authorization, dependability, or certification,
		*throughput, reliability, scalability, responsiveness, efficiency, workload, benchmark, latency,
		speed, improvement, accuracy, achieve, tuning, bottleneck, better, high, optimize, effectiveness,
		low, enhances, reducing, incresaed, quality, faster, or degrades", "environmental, organizational,
MultiNFR D	Word Embedding	coordination, systemic, logistics, coordination, or automation", "graphical, gui, ui, widget, interaction,
Mana 11 16_D	(selected from top 50 words)	habit, prefer, comfortable, friendly, feeling, experience, familiar, desire, customize, intent, disability, or impression",
		'liability, litigation, jurisdiction, regulation, copyright, legislation, enforcement, governmental, directive, civil, right,
		patentability, claim, violate, infringement, counsel, holder, dispute, illegal, judicial, ruling, agreement, ownership,
		comply, authority, law, accountability, abuse, intellectual, obligation, invention, court, ethical, concern, or policy",
		'tolerance, failure, tolerant, byzantine, deadlock, exploiting, reliability, isolation, fault, guarantee, dependable,
		countermeasure, resilience, defensive, corruption, weakness, malfunction, robustness, or stability",
		"adaptability, effectiveness, agility, preventive, dependability, correcting, reuse, defect, mitigation, validated,
		resilience, achievable, remedy, assessing, or maintaining*,
		"flexibility, workload, efficiency, optimize, caching, improvement, robust, overhead, adaptability, scalable, or increased",
		"reliability, dependability, resilience, flexibility, accountability, ensur, disruption, timely, or standby"

Table 4: Binary classification results for top four NFR classes in  $\mathit{Task}$   $\mathit{NFR}$ .

ZSL Classifier		US			SE			0			PE	
	wP	wR	wF1	wP	wR	wF1	wP	wR	wF1	wP	$\mathbf{w}\mathbf{R}$	wF1
$Sbert + (NFR)_A$	0.74	0.40	0.37	0.49	0.28	0.18	0.79	0.45	0.44	0.76	0.39	0.39
$Sbert + (NFR)\_B$	0.71	0.43	0.42	0.35	0.24	0.17	0.78	0.43	0.42	0.75	0.36	0.35
$Sbert + (NFR)\_C$	0.74	0.43	0.41	0.34	0.22	0.19	0.80	0.45	0.44	0.76	0.38	0.38
$Sbert + (NFR)\_D$	0.77	0.78	0.78	0.72	0.71	0.72	0.68	0.72	0.70	0.80	0.67	0.70
$Sbert + (NFR)_E$	0.81	$\underline{0.82}$	0.80	0.76	0.78	0.75	0.68	0.63	0.65	0.78	0.78	0.78
$AllMini + (NFR)\_A$	0.73	0.62	0.64	0.72	0.50	0.51	0.54	0.43	0.47	0.73	0.59	0.63
$AllMini + (NFR)\_B$	0.54	0.35	0.35	0.73	0.73	0.73	0.71	0.65	0.67	0.80	0.70	$\underline{0.78}$
$AllMini + (NFR)\_C$	0.31	0.23	0.17	0.59	0.65	0.61	0.67	0.58	0.61	0.68	0.57	0.60
$AllMini + (NFR)\_D$	0.75	0.75	0.75	0.84	$\underline{0.84}$	$\underline{0.84}$	0.65	0.55	0.58	0.81	0.69	0.71
AllMini + (NFR)_E	0.69	0.71	0.69	0.73	0.72	0.73	0.60	0.54	0.57	0.75	0.73	0.74
$Bert4RE + (NFR)_A$	0.53	0.73	0.62	0.59	0.70	0.62	0.56	0.75	0.64	0.61	0.58	0.59
$Bert4RE + (NFR)_B$	0.51	0.30	0.24	0.81	0.74	0.63	0.67	0.70	0.68	0.61	0.75	0.67*
$Bert4RE + (NFR)_C$	0.52	0.43	0.46	0.62	0.65	0.63	0.72	0.73	$\underline{0.72}$	0.68	0.41	0.43
$Bert4RE + (NFR)_D$	0.54	0.42	0.45	0.56	0.70	0.61	0.63	0.41	0.42	0.60	0.46	0.51
$\_Bert4RE + (NFR)\_E$	0.53	0.73	0.62	0.54	0.73	0.62	0.63	0.40	0.41	0.61	0.78	0.69
$SObert + (NFR)_A$	0.53	0.73	0.62	0.54	0.73	0.62	0.56	0.75	0.64	0.61	0.78	0.69
$SObert + (NFR)_B$	0.55	0.51	0.53	0.81	0.74	0.63	0.65	0.73	0.67	0.61	0.78	0.68
$SObert + (NFR)_C$	0.51	0.32	0.30	0.66	0.53	0.56	0.71	0.74	0.71	0.61	0.55	0.58
$SObert + (NFR)_E$	0.54	0.45	0.48	0.58	0.69	0.61	0.68	0.58	0.61	0.61	0.76	0.67
$SObert + (NFR)_D$	0.53	0.70	0.60	0.63	0.73	0.63	0.68	0.57	0.60	0.66	0.77	0.69

 $\begin{tabular}{l} Table 5: Multi-label classification results for all NFR classes—Top 3 results—369 requirements from PROMISE dataset. \end{tabular}$ 

7CI Classifian		US			SE			О			PE			LF	
ZSL Classifier	Р	R	$\mathbf{F1}$	P	R	F1	Р	R	$\mathbf{F1}$	P	R	F1	Р	R	F1
Sbert + MultiNFR_A	0.74	0.55	0.63	0.78	0.71	0.75	0.56	0.53	0.55	0.73	0.35	0.48	0.64	0.37	0.47
$Sbert + MultiNFR\_B$	0.87	0.51	0.64	0.87	0.62	0.73	0.71	0.74	0.72	0.62	0.69	0.65	0.55	0.76	0.64
$Sbert + MultiNFR\_C$	0.76	0.39	0.51	0.80	0.71	0.75	0.80	0.39	0.52	0.41	0.81	0.54	0.68	0.55	0.61
$Sbert + MultiNFR\_D$	0.82	0.40	0.54	0.90	0.58	0.70	0.63	0.73	0.68	0.81	0.46	0.59	0.46	0.58	0.51
AllMini + MultiNFR_A	0.73	0.45	0.56	0.92	0.88	0.90	0.52	0.90	0.28	0.76	0.46	0.57	1.00	0.32	0.48
$AllMini + MultiNFR\_B$	1.00	0.40	0.57	0.80	0.92	0.86	0.78	0.52	0.62	0.70	0.65	0.67	0.71	0.63	0.67
$AllMini + MultiNFR\_C$	0.79	0.49	0.61	0.96	0.39	0.56	0.49	0.32	0.39	0.56	0.52	0.54	0.79	0.29	0.42
$AllMini + MultiNFR\_D$	1.00	0.36	0.53	1.00	0.22	0.37	0.32	0.35	0.34	1.00	0.33	0.50	0.75	0.32	0.28
Bert4RE + MultiNFR_A	1.00	0.16	0.28	1.00	0.09	0.17	1.00	0.10	0.18	1.00	0.52	0.68	0.60	0.39	0.48
$Bert4RE + MultiNFR\_B$	0.29	0.66	0.40	0.00	0.00	0.00	0.35	0.81	0.49	0.83	0.09	0.17	0.63	0.58	0.60
$Bert4RE + MultiNFR\_C$	1.00	0.06	0.11	0.50	0.27	0.35	0.25	0.71	0.37	1.00	0.13	0.23	0.33	0.37	0.35
$Bert4RE + MultiNFR\_D$	1.00	0.03	0.06	0.00	0.00	0.00	0.22	0.89	0.35	0.30	0.19	0.23	1.00	0.45	0.62
$SObert + MultiNFR\_A$	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.06	0.12	1.00	0.04	0.07	0.00	0.00	0.00
$SObert + MultiNFR\_B$	0.28	0.85	0.43	0.00	0.00	0.00	0.62	0.76	0.68	0.40	0.19	0.25	0.93	0.34	0.50
$SObert  +  MultiNFR\_C$	0.54	0.63	0.58	0.64	0.32	0.42	0.60	0.65	0.62	0.00	0.00	0.00	0.00	0.00	0.00
$SObert + MultiNFR\_E$	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.77	0.55	0.00	0.00	0.00	0.00	0.00	0.00
	SC														
7CI elegation		SC			A			MN			L			FT	
ZSL classifier	P	SC R	F1	P	A R	F1	P	MN R	F1	P	L R	F1	P	FT R	F1
ZSL classifier Sbert + MultiNFR_A	P 0.53		F1 0.63	<b>P</b> 0.41		<b>F1</b> 0.37	<b>P</b> 0.16		<b>F1</b> 0.25	<b>P</b> 0.50		<b>F1</b> 0.38	<b>P</b> 0.22		<b>F1</b> 0.33
		R			R			R			R			R	
Sbert + MultiNFR_A	0.53	R 0.76	0.63	0.41	<b>R</b> 0.33	0.37	0.16	<b>R</b> 0.59	0.25	0.50	<b>R</b> 0.31	0.38	0.22	<b>R</b> 0.70	0.33
Sbert + MultiNFR_A Sbert + MultiNFR_B	<b>0.53</b> 0.55	R 0.76 0.29	<b>0.63</b> 0.38	0.41 0.83	R 0.33 0.24	0.37 0.37	0.16 <b>0.42</b>	R 0.59 <b>0.94</b>	0.25 <b>0.58</b>	0.50 1.00	0.31 0.31	0.38 <b>0.47</b>	0.22 0.20	R 0.70 0.90	0.33 0.32
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C	0.53 0.55 0.36	R 0.76 0.29 0.81	0.63 0.38 0.50	0.41 0.83 0.50	R 0.33 0.24 0.14	0.37 0.37 0.22	0.16 <b>0.42</b> 0.36	R 0.59 0.94 0.47	0.25 <b>0.58</b> 0.41	0.50 1.00 0.38	R 0.31 0.31 0.38	0.38 <b>0.47</b> 0.38	0.22 0.20 0.21	R 0.70 0.90 0.40	0.33 0.32 0.28
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D	0.53 0.55 0.36 0.24	R 0.76 0.29 0.81 0.81	0.63 0.38 0.50 0.38	0.41 0.83 0.50 <b>0.33</b>	R 0.33 0.24 0.14 0.76	0.37 0.37 0.22 <b>0.46</b>	0.16 <b>0.42</b> 0.36 0.57	R 0.59 0.94 0.47 0.47	0.25 <b>0.58</b> 0.41 0.52	0.50 1.00 0.38 0.42	R 0.31 0.31 0.38 0.23	0.38 <b>0.47</b> 0.38 0.30	0.22 0.20 0.21 <b>0.67</b>	R 0.70 0.90 0.40 <b>0.40</b>	0.33 0.32 0.28 <b>0.50</b>
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A	0.53 0.55 0.36 0.24 0.45	R 0.76 0.29 0.81 0.81 0.81	0.63 0.38 0.50 0.38 0.58	0.41 0.83 0.50 <b>0.33</b>	R 0.33 0.24 0.14 0.76 1.00	0.37 0.37 0.22 <b>0.46</b> 0.48	0.16 <b>0.42</b> 0.36 0.57 0.58	R 0.59 0.94 0.47 0.47 0.65	0.25 <b>0.58</b> 0.41 0.52 0.61	0.50 1.00 0.38 0.42 0.43	R 0.31 0.31 0.38 0.23 0.77	0.38 <b>0.47</b> 0.38 0.30 <b>0.56</b>	0.22 0.20 0.21 <b>0.67</b> 0.14	R 0.70 0.90 0.40 0.40 0.70	0.33 0.32 0.28 <b>0.50</b>
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_B	0.53 0.55 0.36 0.24 0.45 0.57	R 0.76 0.29 0.81 0.81 0.81	0.63 0.38 0.50 0.38 0.58 0.57	0.41 0.83 0.50 <b>0.33</b> 0.31 <b>0.54</b>	R 0.33 0.24 0.14 0.76 1.00 0.95	0.37 0.37 0.22 <b>0.46</b> 0.48 <b>0.69</b>	0.16 <b>0.42</b> 0.36 0.57 0.58 <b>0.62</b>	R 0.59 0.94 0.47 0.47 0.65 0.76	0.25 <b>0.58</b> 0.41 0.52 0.61 <b>0.68</b>	0.50 1.00 0.38 0.42 0.43 0.35	R 0.31 0.31 0.38 0.23 0.77 1.00	0.38 <b>0.47</b> 0.38 0.30 <b>0.56</b> 0.52	0.22 0.20 0.21 <b>0.67</b> 0.14 0.24	R 0.70 0.90 0.40 0.40 0.70 0.60	0.33 0.32 0.28 <b>0.50</b> 0.23 0.34
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_B AllMini + MultiNFR_C	0.53 0.55 0.36 0.24 0.45 0.57 0.35	R 0.76 0.29 0.81 0.81 0.81 0.81	0.63 0.38 0.50 0.38 0.58 0.57 0.49	0.41 0.83 0.50 <b>0.33</b> 0.31 <b>0.54</b> 0.15	R 0.33 0.24 0.14 0.76 1.00 0.95	0.37 0.37 0.22 <b>0.46</b> 0.48 <b>0.69</b> 0.26	0.16 <b>0.42</b> 0.36 0.57 0.58 <b>0.62</b> 0.33	R 0.59 0.94 0.47 0.47 0.65 0.76 0.35	0.25 <b>0.58</b> 0.41 0.52 0.61 <b>0.68</b> 0.34	0.50 1.00 0.38 0.42 0.43 0.35 0.50	R 0.31 0.38 0.23 0.77 1.00 0.34	0.38 <b>0.47</b> 0.38 0.30 <b>0.56</b> 0.52 0.52	0.22 0.20 0.21 <b>0.67</b> 0.14 0.24 1.00	R 0.70 0.90 0.40 0.70 0.60 0.50	0.33 0.32 0.28 <b>0.50</b> 0.23 0.34 0.67
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_B AllMini + MultiNFR_C AllMini + MultiNFR_C	0.53 0.55 0.36 0.24 0.45 0.57 0.35 0.22	R 0.76 0.29 0.81 0.81 0.81 0.57 0.81 0.38	0.63 0.38 0.50 0.38 0.58 0.57 0.49 0.28	0.41 0.83 0.50 <b>0.33</b> 0.31 <b>0.54</b> 0.15 0.30	R 0.33 0.24 0.14 0.76 1.00 0.95 0.81 1.00	0.37 0.37 0.22 <b>0.46</b> 0.48 <b>0.69</b> 0.26 0.46	0.16 <b>0.42</b> 0.36 0.57 0.58 <b>0.62</b> 0.33 0.09	R 0.59 0.94 0.47 0.47 0.65 0.76 0.35 0.59	0.25 <b>0.58</b> 0.41 0.52 0.61 <b>0.68</b> 0.34 0.18	0.50 1.00 0.38 0.42 0.43 0.35 0.50 1.00	R 0.31 0.38 0.23 0.77 1.00 0.34 0.31	0.38 <b>0.47</b> 0.38 0.30 <b>0.56</b> 0.52 0.52 0.47	0.22 0.20 0.21 <b>0.67</b> 0.14 0.24 1.00 <b>1.00</b>	R 0.70 0.90 0.40 0.40 0.60 0.60	0.33 0.32 0.28 <b>0.50</b> 0.23 0.34 0.67 <b>0.75</b>
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_B AllMini + MultiNFR_C AllMini + MultiNFR_C Bert4RE + MultiNFR_A	0.53 0.55 0.36 0.24 0.45 0.57 0.35 0.22 1.00	R 0.76 0.29 0.81 0.81 0.57 0.81 0.38	0.63 0.38 0.50 0.38 0.58 0.57 0.49 0.28	0.41 0.83 0.50 <b>0.33</b> 0.31 <b>0.54</b> 0.15 0.30	R 0.33 0.24 0.14 0.76 1.00 0.95 0.81 1.00 0.00	0.37 0.37 0.22 <b>0.46</b> 0.48 <b>0.69</b> 0.26 0.46 <i>0.00</i>	0.16 <b>0.42</b> 0.36 0.57 0.58 <b>0.62</b> 0.33 0.09 0.06	R 0.59 0.94 0.47 0.47 0.65 0.76 0.35 0.59	0.25 <b>0.58</b> 0.41 0.52 0.61 <b>0.68</b> 0.34 0.18	0.50 1.00 0.38 0.42 0.43 0.35 0.50 1.00 0.00	R 0.31 0.38 0.23 0.77 1.00 0.34 0.31 0.00	0.38 0.47 0.38 0.30 0.56 0.52 0.47 0.00	0.22 0.20 0.21 <b>0.67</b> 0.14 0.24 1.00 <b>1.00</b>	R 0.70 0.90 0.40 0.40 0.60 0.60 0.60 0.60	0.33 0.32 0.28 <b>0.50</b> 0.23 0.34 0.67 <b>0.75</b>
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_B AllMini + MultiNFR_C AllMini + MultiNFR_C Bert4RE + MultiNFR_A Bert4RE + MultiNFR_B	0.53 0.55 0.36 0.24 0.45 0.57 0.35 0.22 1.00	R 0.76 0.29 0.81 0.81 0.57 0.81 0.38 0.62	0.63 0.38 0.50 0.38 0.58 0.57 0.49 0.28 0.76 0.09	0.41 0.83 0.50 <b>0.33</b> 0.31 <b>0.54</b> 0.15 0.30 0.00 0.40	R 0.33 0.24 0.14 0.76 1.00 0.95 0.81 1.00 0.00 0.57	0.37 0.37 0.22 <b>0.46</b> 0.48 <b>0.69</b> 0.26 0.46 <i>0.00</i>	0.16 <b>0.42</b> 0.36 0.57 0.58 <b>0.62</b> 0.33 0.09 0.06 1.00	R 0.59 0.94 0.47 0.47 0.65 0.76 0.35 0.59 1.00 0.12	0.25 <b>0.58</b> 0.41 0.52 0.61 <b>0.68</b> 0.34 0.18 0.11 0.21	0.50 1.00 0.38 0.42 0.43 0.50 1.00 0.00 0.00	R 0.31 0.38 0.23 0.77 1.00 0.34 0.31 0.00 0.00	0.38 0.47 0.38 0.30 0.56 0.52 0.47 0.00 0.00	0.22 0.20 0.21 <b>0.67</b> 0.14 0.24 1.00 <b>1.00</b> 0.00	R 0.70 0.90 0.40 0.40 0.50 0.60 0.60 0.00	0.33 0.32 0.28 <b>0.50</b> 0.23 0.34 0.67 <b>0.75</b> 0.00
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_B AllMini + MultiNFR_C AllMini + MultiNFR_D Bert4RE + MultiNFR_B Bert4RE + MultiNFR_B	0.53 0.55 0.36 0.24 0.45 0.57 0.35 0.22 1.00 0.14	R 0.76 0.29 0.81 0.81 0.81 0.57 0.81 0.38 0.62 0.05	0.63 0.38 0.50 0.38 0.58 0.57 0.49 0.28 0.76 0.09	0.41 0.83 0.50 <b>0.33</b> 0.31 <b>0.54</b> 0.15 0.30 0.00 0.40	R 0.33 0.24 0.14 0.76 1.00 0.95 0.81 1.00 0.00 0.57	0.37 0.37 0.22 <b>0.46</b> 0.48 <b>0.69</b> 0.26 0.46 0.46 0.47	0.16 0.42 0.36 0.57 0.58 0.62 0.33 0.09 0.06 1.00 0.67	R 0.59 0.94 0.47 0.65 0.76 0.35 0.59 1.00 0.12 0.47	0.25 <b>0.58</b> 0.41 0.52 0.61 <b>0.68</b> 0.34 0.18 0.11 0.21 <b>0.55</b>	0.50 1.00 0.38 0.42 0.43 0.35 0.50 1.00 0.00 0.00	R 0.31 0.38 0.23 0.77 1.00 0.34 0.31 0.00 0.00	0.38 0.47 0.38 0.30 0.56 0.52 0.47 0.00 0.00	0.22 0.20 0.21 <b>0.67</b> 0.14 0.24 1.00 <b>1.00</b> 0.00 0.00	R 0.70 0.90 0.40 0.40 0.50 0.60 0.60 0.00 0.10	0.33 0.32 0.28 <b>0.50</b> 0.23 0.34 0.67 <b>0.75</b> 0.00 0.00
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_C AllMini + MultiNFR_C AllMini + MultiNFR_D Bert4RE + MultiNFR_A Bert4RE + MultiNFR_B Bert4RE + MultiNFR_C Bert4RE + MultiNFR_C	0.53 0.55 0.36 0.24 0.45 0.57 0.35 0.22 1.00 1.00 0.14 0.24	R 0.76 0.29 0.81 0.81 0.57 0.81 0.38 0.62 0.05 0.05	0.63 0.38 0.50 0.38 0.58 0.57 0.49 0.28 0.76 0.09 0.07	0.41 0.83 0.50 <b>0.33</b> 0.31 <b>0.54</b> 0.15 0.30 0.00 0.40 0.24 <b>1.00</b>	R 0.33 0.24 0.14 0.76 1.00 0.95 0.81 1.00 0.00 0.57 0.62 0.76	0.37 0.37 0.22 <b>0.46</b> 0.48 <b>0.69</b> 0.26 0.46 0.00 0.47 0.35 <b>0.86</b>	0.16 <b>0.42</b> 0.36 0.57 0.58 <b>0.62</b> 0.33 0.09 0.06 1.00 <b>0.67</b>	R 0.59 0.94 0.47 0.47 0.65 0.76 0.35 0.59 1.00 0.12 0.47 0.65	0.25 <b>0.58</b> 0.41 0.52 0.61 <b>0.68</b> 0.34 0.18 0.11 0.21 <b>0.55</b>	0.50 1.00 0.38 0.42 0.43 0.35 0.50 1.00 0.00 0.00 0.00 0.00	R 0.31 0.38 0.23 0.77 1.00 0.34 0.31 0.00 0.00 0.00	0.38 0.47 0.38 0.30 0.56 0.52 0.47 0.00 0.00 0.00 0.00	0.22 0.20 0.21 <b>0.67</b> 0.14 0.24 1.00 <b>1.00</b> 0.00 0.00 <b>0.00</b>	R 0.70 0.90 0.40 0.60 0.50 0.60 0.00 0.10 0.00	0.33 0.32 0.28 <b>0.50</b> 0.23 0.34 0.67 <b>0.75</b> 0.00 <b>0.07</b>
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_B AllMini + MultiNFR_C AllMini + MultiNFR_C AllMini + MultiNFR_D Bert4RE + MultiNFR_A Bert4RE + MultiNFR_B Bert4RE + MultiNFR_B Sobert + MultiNFR_D SObert + MultiNFR_A	0.53 0.55 0.36 0.24 0.45 0.57 0.35 0.22 1.00 1.00 0.14 0.24 0.00	R 0.76 0.29 0.81 0.81 0.57 0.81 0.38 0.62 0.05 0.05 0.19	0.63 0.38 0.50 0.38 0.58 0.57 0.49 0.28 0.76 0.09 0.07 0.21 0.00	0.41 0.83 0.50 <b>0.33</b> 0.31 <b>0.54</b> 0.15 0.30 0.40 0.24 <b>1.00</b>	R 0.33 0.24 0.14 0.76 1.00 0.95 0.81 1.00 0.57 0.62 0.76 0.00	0.37 0.37 0.22 <b>0.46</b> 0.48 <b>0.69</b> 0.26 0.46 0.47 0.35 <b>0.86</b>	0.16 0.42 0.36 0.57 0.58 0.62 0.33 0.09 0.06 1.00 0.67 0.37	R 0.59 0.94 0.47 0.65 0.76 0.35 0.59 1.00 0.12 0.47 0.65 0.94	0.25 0.58 0.41 0.52 0.61 0.68 0.34 0.18 0.11 0.21 0.55 0.47	0.50 1.00 0.38 0.42 0.43 0.50 1.00 0.00 0.00 0.00 0.00 0.00	R 0.31 0.38 0.23 0.77 1.00 0.34 0.31 0.00 0.00 0.00 0.00	0.38 0.47 0.38 0.30 0.56 0.52 0.47 0.00 0.00 0.00 0.00	0.22 0.20 0.21 <b>0.67</b> 0.14 0.24 1.00 <b>1.00</b> 0.00 0.00 0.05	R 0.70 0.90 0.40 0.40 0.50 0.60 0.00 0.10 0.00 1.00	0.33 0.32 0.28 <b>0.50</b> 0.23 0.34 0.67 <b>0.75</b> 0.00 0.00 <b>0.07</b>

Table 6: Overall performance results of multi-class classification of all 10 NFR classes in PROMISE dataset (369 requirements) for  $Task\ NFR$ .

701 (1		US			SE			О			PE			LF	
ZSL Classifier	Р	R	F1	Р	R	F1	P	R	F1	Р	R	F1	P	R	F1
Sbert + MultiNFR_A	0.50	0.21	0.29	0.56	0.44	0.49	0.29	0.24	0.26	0.29	0.07	0.12	0.33	0.13	0.19
$Sbert + MultiNFR\_B$	0.64	0.31	0.42	0.76	0.38	0.51	0.44	0.32	0.37	0.30	0.26	0.28	0.34	0.58	0.43
$Sbert  +  MultiNFR\_C$	0.28	0.07	0.12	0.57	0.44	0.50	0.52	0.18	0.27	0.15	0.31	0.20	0.28	0.18	0.22
$Sbert + MultiNFR\_D$	0.39	0.10	0.16	0.74	0.30	0.43	3.32	0.32	0.32	0.61	0.20	0.31	0.20	0.29	0.23
AllMini + MultiNFR_A	0.48	0.16	0.24	0.79	0.62	0.69	0.20	0.06	0.10	0.56	0.28	0.37	1.00	0.13	0.23
$AllMini+MultiNFR\_B$	1.00	0.13	0.24	0.70	0.67	0.68	0.60	0.29	0.39	0.13	0.06	0.08	0.51	0.47	0.49
$AllMini+MultiNFR\_C$	0.28	0.07	0.12	0.88	0.21	0.34	0.18	0.15	0.16	0.29	0.28	0.28	0.22	0.05	0.09
$AllMini + MultiNFR\_D$	1.00	0.01	0.03	1.00	0.02	0.03	0.16	0.19	0.18	1.00	0.02	0.04	0.00	0.00	0.00
Bert4RE + MultiNFR_A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.18	0.14
$Bert4RE + MultiNFR\_B$	0.23	0.60	0.33	0.00	0.00	0.00	0.17	0.39	0.24	0.50	0.02	0.04	0.05	0.03	0.04
$Bert4RE + MultiNFR\_C$	0.00	0.00	0.00	0.16	0.06	0.09	0.16	0.47	0.23	0.00	0.00	0.00	0.19	0.21	0.20
$\_Bert4RE + MultiNFR\_D$	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.73	0.26	0.19	0.13	0.16	0.00	0.00	0.00
$SObert  +  MultiNFR\_A$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.95	0.18
$SObert  +  MultiNFR\_B$	0.21	0.81	0.33	0.00	0.00	0.00	0.16	0.11	0.13	0.14	0.06	0.08	0.50	0.05	0.10
$SObert  +  MultiNFR\_C$	0.23	0.18	0.20	0.16	0.05	0.07	0.29	0.21	0.24	0.00	0.00	0.00	0.00	0.00	0.00
$SObert + MultiNFR\_E$	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.34	0.26	0.00	0.00	0.00	0.00	0.00	0.00
	SC														
7CI Classifier		$\mathbf{sc}$			A			MN			L			FT	
ZSL Classifier	P	SC R	F1	P	A R	F1	P	MN R	F1	P	L R	F1	P	FT R	F1
ZSL Classifier Sbert + MultiNFR_A	P 0.24		F1 0.32	<b>P</b> 0.11		<b>F1</b> 0.10	<b>P</b> 0.09		<b>F1</b> 0.15	<b>P</b> 0.38		<b>F1</b> 0.29	<b>P</b> 0.04		<b>F1</b> 0.07
		R			R			R			R			R	
Sbert + MultiNFR_A	0.24	R 0.48	0.32	0.11	<b>R</b> 0.10	0.10	0.09	<b>R</b> 0.47	0.15	0.38	<b>R</b> 0.23	0.29	0.04	<b>R</b> 0.20	0.07
Sbert + MultiNFR_A Sbert + MultiNFR_B	<b>0.24</b> 0.20	R 0.48 0.14	<b>0.32</b> 0.17	0.11 0.00	R 0.10 0.00	0.10 0.00	0.09 <b>0.22</b>	R 0.47 <u><b>0.71</b></u>	0.15 <b>0.33</b>	0.38 <u>0.67</u>	R 0.23 <b>0.31</b>	0.29 <b>0.42</b>	0.04 <b>0.07</b>	R 0.20 <u><b>0.50</b></u>	0.07 <b>0.13</b>
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C	0.24 0.20 0.05	R 0.48 0.14 0.14	0.32 0.17 0.08	0.11 0.00 0.00	R 0.10 0.00 0.00	0.10 0.00 0.00	0.09 <b>0.22</b> 0.09	R 0.47 0.71 0.18	0.15 <b>0.33</b> 0.12	0.38 <u>0.67</u> 0.14	R 0.23 0.31 0.23	0.29 <b>0.42</b> 0.18	0.04 <b>0.07</b> 0.09	R 0.20 0.50 0.20	0.07 <b>0.13</b> 0.12
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D	0.24 0.20 0.05 0.15	R 0.48 0.14 0.14 0.76	0.32 0.17 0.08 0.25	0.11 0.00 0.00 <b>0.10</b>	R 0.10 0.00 0.00 0.24	0.10 0.00 0.00 0.14	0.09 <b>0.22</b> 0.09 0.08	R 0.47 0.71 0.18 0.06	0.15 <b>0.33</b> 0.12 0.07	0.38 <b>0.67</b> 0.14 0.18	R 0.23 0.31 0.23 0.15	0.29 <b>0.42</b> 0.18 0.17	0.04 <b>0.07</b> 0.09 0.00	R 0.20 0.50 0.20 0.00	0.07 <b>0.13</b> 0.12 0.00
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A	0.24 0.20 0.05 0.15 0.27	R 0.48 0.14 0.14 0.76 0.62	0.32 0.17 0.08 0.25 0.38	0.11 0.00 0.00 0.10 0.18	R 0.10 0.00 0.00 0.24 0.86	0.10 0.00 0.00 0.14 0.30	0.09 <b>0.22</b> 0.09 0.08 0.24	R 0.47 0.71 0.18 0.06 0.41	0.15 <b>0.33</b> 0.12 0.07 0.30	0.38 0.67 0.14 0.18 0.05	R 0.23 0.31 0.23 0.15 0.08	0.29 <b>0.42</b> 0.18 0.17 0.06	0.04 <b>0.07</b> 0.09 0.00 0.07	R 0.20 0.50 0.20 0.00 0.30	0.07 <b>0.13</b> 0.12 <i>0.00</i> 0.11
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_B	0.24 0.20 0.05 0.15 0.27 0.25	R 0.48 0.14 0.14 0.76 0.62 0.33	0.32 0.17 0.08 0.25 0.38 0.29	0.11 0.00 0.00 0.10 0.18 0.13	R 0.10 0.00 0.00 0.24 0.86 0.43	0.10 0.00 0.00 0.14 0.30 0.21	0.09 <b>0.22</b> 0.09 0.08 0.24 <b>0.42</b>	R 0.47 0.71 0.18 0.06 0.41 0.47	0.15 <b>0.33</b> 0.12 0.07 0.30 <b>0.44</b>	0.38 <u>0.67</u> 0.14 0.18 0.05 <b>0.20</b>	R 0.23 0.31 0.23 0.15 0.08 0.69	0.29 <b>0.42</b> 0.18 0.17 0.06 <b>0.32</b>	0.04 <b>0.07</b> 0.09 0.00 0.07 0.11	R 0.20 0.50 0.20 0.00 0.30 0.60	0.07 <b>0.13</b> 0.12 0.00 0.11 0.19
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_B AllMini + MultiNFR_C	0.24 0.20 0.05 0.15 0.27 0.25 0.12	R 0.48 0.14 0.14 0.76 0.62 0.33 0.29	0.32 0.17 0.08 0.25 0.38 0.29 0.17	0.11 0.00 0.00 0.10 0.18 0.13 0.09	R 0.10 0.00 0.00 0.24 0.86 0.43 0.62	0.10 0.00 0.00 0.14 0.30 0.21 0.16	0.09 <b>0.22</b> 0.09 0.08 0.24 <b>0.42</b> 0.07	R 0.47 0.71 0.18 0.06 0.41 0.47 0.06	0.15 <b>0.33</b> 0.12 0.07 0.30 <b>0.44</b> 0.06	0.38 0.67 0.14 0.18 0.05 0.20 0.28	R 0.23 0.31 0.23 0.15 0.08 0.69 0.38	0.29 0.42 0.18 0.17 0.06 0.32 0.32	0.04 0.07 0.09 0.00 0.07 0.11 0.50	R 0.20 0.50 0.20 0.00 0.30 0.60 0.20	0.07 <b>0.13</b> 0.12 0.00 0.11 0.19 0.29
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_B AllMini + MultiNFR_C AllMini + MultiNFR_C	0.24 0.20 0.05 0.15 0.27 0.25 0.12 0.02	R 0.48 0.14 0.76 0.62 0.33 0.29 0.05	0.32 0.17 0.08 0.25 0.29 0.17 0.03	0.11 0.00 0.00 0.10 0.18 0.13 0.09 0.12	R 0.10 0.00 0.00 0.24 0.86 0.43 0.62 0.52	0.10 0.00 0.00 0.14 0.30 0.21 0.16 0.19	0.09 0.22 0.09 0.08 0.24 0.42 0.07 0.05	R 0.47 0.71 0.18 0.06 0.41 0.47 0.06 0.05	0.15 0.33 0.12 0.07 0.30 0.44 0.06 0.03	0.38 0.67 0.14 0.18 0.05 0.20 0.28 0.00	R 0.23 0.31 0.23 0.15 0.08 0.69 0.38 0.00	0.29 0.42 0.18 0.17 0.06 0.32 0.00	0.04 0.07 0.09 0.00 0.07 0.11 0.50 1.00	R 0.20 0.50 0.20 0.00 0.30 0.60 0.20 0.20	0.07 <b>0.13</b> 0.12 0.00 0.11 0.19 0.29 <b>0.33</b>
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_B AllMini + MultiNFR_C AllMini + MultiNFR_C AllMini + MultiNFR_C Bert4RE + MultiNFR_A	0.24 0.20 0.05 0.15 0.27 0.25 0.12 0.02	R 0.48 0.14 0.76 0.62 0.33 0.29 0.05	0.32 0.17 0.08 0.25 0.38 0.29 0.17 0.03 0.00	0.11 0.00 0.00 0.10 0.18 0.13 0.09 0.12 0.00	R 0.10 0.00 0.00 0.24 0.86 0.43 0.62 0.52	0.10 0.00 0.00 0.14 0.30 0.21 0.16 0.19 0.00	0.09 0.22 0.09 0.08 0.24 0.42 0.07 0.05 0.06	R 0.47 0.18 0.06 0.41 0.47 0.06 0.05	0.15 0.33 0.12 0.07 0.30 0.44 0.06 0.03 0.10	0.38 0.67 0.14 0.18 0.05 0.20 0.28 0.00	R 0.23 0.31 0.23 0.15 0.08 0.69 0.38 0.00 0.00	0.29 0.42 0.18 0.17 0.06 0.32 0.00 0.00	0.04 0.07 0.09 0.00 0.07 0.11 0.50 1.00 0.00	R 0.20 0.50 0.20 0.00 0.30 0.60 0.20 0.20 0.20 0.00	0.07 <b>0.13</b> 0.12 0.00 0.11 0.19 0.29 <b>0.33</b>
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_B AllMini + MultiNFR_C AllMini + MultiNFR_C AllMini + MultiNFR_D Bert4RE + MultiNFR_A Bert4RE + MultiNFR_B	0.24 0.20 0.05 0.15 0.27 0.25 0.12 0.02 0.00 0.00	R 0.48 0.14 0.14 0.76 0.62 0.33 0.29 0.05 0.00 0.00	0.32 0.17 0.08 0.25 0.38 0.29 0.17 0.03 0.00 0.00	0.11 0.00 0.00 0.10 0.18 0.13 0.09 0.12 0.00 0.07	R 0.10 0.00 0.00 0.24 0.86 0.43 0.62 0.52 0.00 0.10	0.10 0.00 0.00 0.14 0.30 0.21 0.16 0.19 0.00	0.09 0.22 0.09 0.08 0.24 0.42 0.07 0.05 0.06 0.00	R 0.47 0.18 0.06 0.41 0.06 0.05 0.94 0.00	0.15 0.33 0.12 0.07 0.30 0.44 0.06 0.03 0.10 0.00	0.38 0.67 0.14 0.18 0.05 0.20 0.28 0.00 0.00	R 0.23 0.31 0.23 0.15 0.08 0.69 0.38 0.00 0.00	0.29 0.42 0.18 0.17 0.06 0.32 0.00 0.00 0.00	0.04 0.07 0.09 0.00 0.07 0.11 0.50 1.00 0.00 0.00	R 0.20 0.50 0.20 0.00 0.30 0.60 0.20 0.20 0.00 0.00	0.07 <b>0.13</b> 0.12 0.00 0.11 0.19 0.29 <b>0.33</b> 0.00 0.00
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_C AllMini + MultiNFR_C AllMini + MultiNFR_D Bert4RE + MultiNFR_A Bert4RE + MultiNFR_B Bert4RE + MultiNFR_B	0.24 0.20 0.05 0.15 0.27 0.25 0.12 0.02 0.00 0.00 0.13	R 0.48 0.14 0.14 0.76  0.62 0.33 0.29 0.05 0.00 0.005	0.32 0.17 0.08 0.25 0.38 0.29 0.17 0.03 0.00 0.00 0.07	0.11 0.00 0.00 0.10 0.18 0.13 0.09 0.12 0.00 0.07	R 0.10 0.00 0.00 0.24 0.86 0.43 0.62 0.52 0.00 0.10 0.19	0.10 0.00 0.00 0.14 0.30 0.21 0.16 0.19 0.00 0.08	0.09 0.22 0.09 0.08 0.24 0.07 0.05 0.06 0.00 0.00	R 0.47 0.18 0.06 0.41 0.06 0.05 0.094 0.00 0.00	0.15 0.33 0.12 0.07 0.30 0.44 0.06 0.03 0.10 0.00 0.00	0.38 0.67 0.14 0.18 0.05 0.20 0.28 0.00 0.00 0.00 0.00	R 0.23 0.31 0.23 0.15 0.08 0.69 0.38 0.00 0.00 0.00	0.29 0.42 0.18 0.17 0.06 0.32 0.00 0.00 0.00 0.00	0.04 0.07 0.09 0.00 0.07 0.11 0.50 1.00 0.00 0.00	R 0.20 0.50 0.20 0.00 0.30 0.60 0.20 0.20 0.00 0.00 0.00	0.07 0.13 0.12 0.00 0.11 0.19 0.29 0.33 0.00 0.00
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_C AllMini + MultiNFR_C AllMini + MultiNFR_D Bert4RE + MultiNFR_A Bert4RE + MultiNFR_B Bert4RE + MultiNFR_C Bert4RE + MultiNFR_C	0.24 0.20 0.05 0.15 0.27 0.25 0.12 0.02 0.00 0.00 0.13 0.00	R 0.48 0.14 0.14 0.76 0.62 0.33 0.29 0.05 0.00 0.005 0.000	0.32 0.17 0.08 0.25 0.38 0.29 0.17 0.03 0.00 0.00 0.07	0.11 0.00 0.00 0.10 0.18 0.13 0.09 0.12 0.00 0.07 0.07	R 0.10 0.00 0.00 0.24 0.86 0.43 0.62 0.52 0.00 0.10 0.19 0.00	0.10 0.00 0.00 0.14 0.30 0.21 0.16 0.19 0.00 0.08 0.10	0.09 0.22 0.09 0.08 0.24 0.42 0.07 0.05 0.06 0.00 0.00 0.03	R 0.47 0.18 0.06 0.41 0.47 0.06 0.05 0.94 0.00 0.00	0.15 0.33 0.12 0.07 0.30 0.44 0.06 0.03 0.10 0.00 0.00 0.004	0.38 0.67 0.14 0.18 0.05 0.20 0.28 0.00 0.00 0.00 0.00	R 0.23 0.31 0.23 0.15 0.08 0.69 0.38 0.00 0.00 0.00 0.00 0.00	0.29 0.42 0.18 0.17 0.06 0.32 0.00 0.00 0.00 0.00 0.00	0.04 0.07 0.09 0.00 0.07 0.11 0.50 1.00 0.00 0.00 0.00 0.00	R 0.20 0.50 0.20 0.00 0.30 0.60 0.20 0.20 0.00 0.00 0.00 0.00	0.07 0.13 0.12 0.00 0.11 0.19 0.29 0.33 0.00 0.00 0.00
Sbert + MultiNFR_A Sbert + MultiNFR_B Sbert + MultiNFR_C Sbert + MultiNFR_D AllMini + MultiNFR_A AllMini + MultiNFR_B AllMini + MultiNFR_C AllMini + MultiNFR_D Bert4RE + MultiNFR_A Bert4RE + MultiNFR_B Bert4RE + MultiNFR_B Scheduler Bert4RE + MultiNFR_C Bert4RE + MultiNFR_C Scheduler Scheduler	0.24 0.20 0.05 0.15 0.27 0.25 0.12 0.02 0.00 0.00 0.13 0.00 0.00	R 0.48 0.14 0.14 0.76 0.62 0.33 0.29 0.05 0.00 0.00 0.00	0.32 0.17 0.08 0.25 0.38 0.29 0.17 0.03 0.00 0.00 0.00 0.00	0.11 0.00 0.00 0.10 0.18 0.13 0.09 0.12 0.00 0.07 0.07 0.00	R 0.10 0.00 0.00 0.24 0.86 0.43 0.62 0.52 0.00 0.10 0.19 0.00	0.10 0.00 0.00 0.14 0.30 0.21 0.16 0.19 0.00 0.08 0.10 0.00	0.09 0.22 0.09 0.08 0.24 0.42 0.07 0.05 0.06 0.00 0.03 0.00	R 0.47 0.18 0.06 0.41 0.47 0.06 0.05 0.94 0.00 0.06 0.06	0.15 0.33 0.12 0.07 0.30 0.44 0.06 0.03 0.10 0.00 0.04 0.00	0.38	R 0.23 0.31 0.23 0.15 0.08 0.69 0.38 0.00 0.00 0.00 0.00 0.00	0.29 0.42 0.18 0.17 0.06 0.32 0.00 0.00 0.00 0.00 0.00	0.04 0.07 0.09 0.00 0.07 0.11 0.50 1.00 0.00 0.00 0.00 0.00	R 0.20 0.50 0.20 0.00 0.30 0.60 0.20 0.20 0.00 0.00 0.00 0.00 0.0	0.07 0.13 0.12 0.00 0.11 0.19 0.29 0.33 0.00 0.00 0.00 0.00

Table 7: Overall classification results for  $Task\ Security$ , considering all the requirements in SecReq as a single dataset.

ZSL Classifier	wP	$\mathbf{w}\mathbf{R}$	wF1
$Sbert + Sec\_A$	0.62	0.40	0.30
$Sbert + Sec\_B$	0.58	0.39	0.28
$Sbert + Sec\_C$	0.58	0.41	0.31
$Sbert + Sec\_D$	0.56	0.40	0.31
$AllMini  +  Sec\_A$	0.69	0.58	0.58
$AllMini + Sec\_B$	0.68	0.65	0.66
$AllMini + Sec\_C$	0.65	0.45	0.38
AllMini + Sec_D	0.52	0.45	0.45
$Bert4RE + Sec\_A$	0.52	0.53	0.52
$Bert4RE + Sec\_B$	0.40	0.63	0.49
$Bert4RE + Sec\_C$	0.48	0.39	0.36
$Bert4RE + Sec\_D$	0.50	0.50	0.50
$SObert + Sec\_A$	0.40	0.63	0.49
$SObert + Sec\_B$	0.40	0.63	0.49
$SObert + Sec\_C$	0.56	0.54	0.55
$SObert + Sec\_D$	0.70	0.46	0.39