

AppTracker1: SAP analysis for GPAMs

Oana Andrei

Interpreting the results. For a given data set, a value for K , and inferred model (either PAM or GPAM), we model check properties for each of the activity patterns. To aid interpretation of the quantitative results, we order them from “best” to “worst”, which is greatest to least value for **VisitProb** and **VisitCount** and the least to greatest value for **StepCount**. We encode the ordering using colours for maximum five activity patterns thus: blue, purple, orange, green, black, ranging from “best” results to “worse” results respectively. If the result of model checking a reward-based property does not produce a number (due to state unreachability, or filter satisfying no states, or the iterative method not converging within 100,000 iterations) this is denoted by “—”.

The unit for the time intervals is days. For simplicity, assume $N = 50$ for all time-bounded properties.

Table 1: Property $VP_{\text{sessionAP}}$ in GPAM with $K = 2$ and time interval $[30, 60]$

Target state	Main		OverallUsage		StackedBars		PeriodSelector		Stats	
	AP1	AP2	AP1	AP2	AP1	AP2	AP1	AP2	AP1	AP2
OverallUsage	0.23	0.98	1.00	1.00	0.15	0.75	0.18	0.43	0.37	0.39
StackedBars	0.49	0.04	0.49	0.00	1.00	1.00	0.40	0.02	0.49	0.00
PeriodSelector	0.27	0.00	0.27	0.00	0.17	0.02	1.00	1.00	0.27	0.00
Stats	0.06	0.30	0.29	0.30	0.04	0.23	0.05	0.13	1.00	1.00
UseStop	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Table 2: Property $VP_{\text{sessionAP}}$ in GPAM with $K = 3$ and time interval $[30, 60]$

Target state	Main			OverallUsage			StackedBars			PeriodSelector			Stats		
	AP1	AP2	AP3	AP1	AP2	AP3	AP1	AP2	AP3	AP1	AP2	AP3	AP1	AP2	AP3
OverallUsage	0.97	0.06	0.08	1.00	1.00	1.00	0.96	0.02	0.06	0.39	0.02	0.08	0.71	—	0.42
StackedBars	0.56	0.70	0.33	0.53	0.70	0.00	1.00	1.00	0.21	0.27	0.33	0.40	—	—	0.00
PeriodSelector	0.13	0.12	0.28	0.12	0.12	0.00	0.13	0.04	0.21	1.00	1.00	1.00	0.09	—	0.00
Stats	0.85	0.00	0.02	0.87	0.00	0.28	0.84	0.00	0.01	0.33	0.00	0.02	1.00	—	1.00
UseStop	0.68	0.99	0.99	0.68	0.99	0.99	0.67	0.99	0.99	0.39	0.98	0.99	0.76	—	0.99

Table 3: Property $VP_{\text{sessionAP}}$ in GPAM with $K = 4$ and time interval $[30, 60]$

Target state	Main				OverallUsage				StackedBars				PeriodSelector				Stats			
	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4
OverallUsage	0.02	0.58	1.00	0.08	1.00	1.00	1.00	1.00	0.02	0.50	1.00	1.00	0.00	0.03	0.53	—	0.00	0.00	0.67	0.73
StackedBars	0.24	0.43	0.20	0.89	0.00	0.43	0.13	0.89	1.00	1.00	1.00	1.00	0.03	0.39	—	0.03	0.00	0.43	0.12	—
PeriodSelector	0.12	0.98	0.00	0.08	0.00	0.98	0.00	0.08	0.12	0.85	0.00	0.00	1.00	1.00	—	1.00	0.00	0.98	0.00	—
Stats	0.00	0.16	0.40	0.00	0.36	0.29	0.40	0.00	0.00	0.13	0.39	0.00	0.00	0.14	—	0.00	1.00	1.00	1.00	—
UseStop	0.90	0.08	0.46	0.99	0.99	0.09	0.48	0.99	0.90	0.21	0.46	0.99	0.30	0.07	—	0.99	0.99	0.08	0.60	—

Table 4: Property $VP_{\text{sessionAP}}$ in GPAM with $K = 5$ and time interval $[30, 60]$

Target state	Main					OverallUsage					StackedBars				
	AP1	AP2	AP3	AP4	AP5	AP1	AP2	AP3	AP4	AP5	AP1	AP2	AP3	AP4	AP5
OverallUsage	0.00	0.64	0.99	0.01	0.11	—	1.00	1.00	1.00	1.00	0.00	0.14	0.98	—	0.01
StackedBars	0.77	0.89	0.16	0.00	0.83	—	0.89	0.10	0.00	0.82	1.00	1.00	1.00	—	1.00
PeriodSelector	0.00	0.86	0.00	0.16	0.19	—	0.86	0.00	0.00	0.19	0.00	0.20	0.00	—	0.00
Stats	0.00	0.20	0.19	0.00	0.00	—	0.33	0.20	0.34	0.00	0.00	0.04	0.19	—	0.00
UseStop	0.99	0.82	0.05	0.87	0.99	—	0.81	0.04	0.99	0.99	0.99	0.95	0.06	—	0.99

Table 5: Property $VP_{\text{sessionAP}}$ in GPAM with $K = 5$ and time interval $[30, 60]$

Target state	PeriodSelector					Stats				
	AP1	AP2	AP3	AP4	AP5	AP1	AP2	AP3	AP4	AP5
OverallUsage	—	0.64	—	0.00	0.03	—	0.72	0.79	0.00	—
StackedBars	—	0.89	—	0.00	0.27	—	0.89	0.10	0.00	—
PeriodSelector	1.00	—	1.00	1.00	—	0.86	0.00	0.00	—	—
Stats	—	0.20	—	0.00	0.00	—	1.00	1.00	1.00	—
UseStop	—	0.81	—	0.47	0.99	—	0.81	0.23	0.99	—

Table 6: Property $VP_{\text{sessionAP}}$ in GPAM with $K = 2$ and time interval $[60, 90]$

Target state	Main		OverallUsage		StackedBars		PeriodSelector		Stats	
	AP1	AP2	AP1	AP2	AP1	AP2	AP1	AP2	AP1	AP2
OverallUsage	0.32	1.00	1.00	1.00	0.21	1.00	0.20	0.30	0.65	0.45
StackedBars	0.49	0.00	0.49	0.00	1.00	1.00	0.31	0.00	0.49	0.00
PeriodSelector	0.32	0.00	0.33	0.00	0.23	0.00	1.00	1.00	0.33	0.00
Stats	0.13	0.22	0.41	0.22	0.08	0.22	0.08	0.06	1.00	1.00
UseStop	0.99	0.99	0.99	0.99	0.99	0.99	0.98	0.99	0.99	0.99

Table 7: Property $VP_{\text{sessionAP}}$ in GPAM with $K = 3$ and time interval $[60, 90]$

Target state	Main			OverallUsage			StackedBars			PeriodSelector			Stats		
	AP1	AP2	AP3	AP1	AP2	AP3	AP1	AP2	AP3	AP1	AP2	AP3	AP1	AP2	AP3
OverallUsage	0.98	0.21	0.27	1.00	1.00	1.00	0.80	0.11	0.26	0.14	0.11	0.16	0.45	0.71	0.39
StackedBars	0.05	0.55	0.29	0.00	0.55	0.28	1.00	1.00	1.00	0.00	0.30	0.17	0.00	0.55	0.28
PeriodSelector	0.01	0.05	0.60	0.00	0.05	0.60	0.13	0.02	0.59	1.00	1.00	1.00	0.00	0.05	0.61
Stats	0.26	0.05	0.12	0.27	0.27	0.47	0.21	0.03	0.12	0.03	0.03	0.07	1.00	1.00	1.00
UseStop	0.99	0.99	0.96	0.99	0.99	0.93	0.99	0.99	0.96	0.99	0.98	0.96	0.99	0.99	0.94

Table 8: Property $VP_{\text{sessionAP}}$ in GPAM with $K = 4$ and time interval $[60, 90]$

Target state	Main				OverallUsage				StackedBars				PeriodSelector				Stats			
	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4
OverallUsage	0.02	0.99	0.98	0.25	1.00	1.00	1.00	1.00	0.00	0.99	0.89	0.25	0.00	—	0.17	0.15	0.98	0.64	0.64	0.39
StackedBars	0.24	0.96	0.07	0.31	0.09	0.90	0.00	0.30	1.00	1.00	1.00	1.00	0.00	—	0.01	0.18	0.09	0.62	0.00	0.30
PeriodSelector	0.09	0.00	0.02	0.57	0.03	0.00	0.00	0.57	0.01	0.00	0.13	0.57	1.00	—	1.00	1.00	0.03	0.00	0.00	0.58
Stats	0.00	0.77	0.23	0.13	0.31	0.80	0.24	0.52	0.00	0.76	0.21	0.13	0.00	—	0.04	0.07	1.00	1.00	1.00	1.00
UseStop	0.90	0.39	0.99	0.96	0.96	0.42	0.99	0.93	0.98	0.38	0.99	0.96	0.79	—	0.99	0.95	0.96	0.60	0.99	0.94

Table 9: Property $\text{VPsession}_{\text{AP}}$ in GPAM with $K = 5$ and time interval $[60, 90]$

Target state	Main					OverallUsage					StackedBars				
	AP1	AP2	AP3	AP4	AP5	AP1	AP2	AP3	AP4	AP5	AP1	AP2	AP3	AP4	AP5
OverallUsage	0.96	1.00	0.04	0.50	0.13	1.00	1.00	1.00	1.00	1.00	0.77	—	0.04	—	0.08
StackedBars	0.53	0.00	0.47	0.00	0.43	0.46	0.00	0.18	0.00	0.39	1.00	—	1.00	—	1.00
PeriodSelector	0.04	0.00	0.19	0.90	0.36	0.04	0.00	0.18	0.86	0.35	0.05	—	0.17	—	0.21
Stats	0.76	0.12	0.01	0.19	0.04	0.79	0.12	0.34	0.37	0.35	0.61	—	0.01	—	0.02
UseStop	0.95	0.99	0.98	0.98	0.98	0.95	0.99	0.88	0.98	0.96	0.96	—	0.98	—	0.99

Table 10: Property $\text{VPsession}_{\text{AP}}$ in GPAM with $K = 5$ and time interval $[60, 90]$

Target state	PeriodSelector					Stats				
	AP1	AP2	AP3	AP4	AP5	AP1	AP2	AP3	AP4	AP5
OverallUsage	0.40	0.33	0.04	0.29	0.08	0.68	0.46	0.99	0.40	0.28
StackedBars	0.22	0.00	0.44	0.00	0.25	0.34	0.00	0.18	0.00	0.41
PeriodSelector	1.00	1.00	1.00	1.00	1.00	0.02	0.00	0.18	0.73	0.40
Stats	0.31	0.04	0.01	0.10	0.02	1.00	1.00	1.00	1.00	1.00
UseStop	0.97	0.99	0.94	0.99	0.97	0.96	0.99	0.88	0.99	0.97

Table 11: Property SCstate2stateAp in GPAM with $K = 2$ and time interval [30, 60]

Target state	Main		OverallUsage		StackedBars		PeriodSelector		Stats	
	AP1	AP2	AP1	AP2	AP1	AP2	AP1	AP2	AP1	AP2
OverallUsage	23.09	1.14	0.00	0.00	24.47	2.77	29.19	5.49	20.66	4.00
StackedBars	8.62	135.72	10.16	141.46	0.00	0.00	14.74	140.28	10.62	141.49
PeriodSelector	17.57	5482.62	19.11	5488.33	19.38	5347.62	0.00	0.00	19.57	5488.37
Stats	86.10	15.24	66.24	14.10	87.15	16.80	92.01	19.44	0.00	0.00
UseStop	6.11	4.42	7.66	3.36	5.00	4.53	10.80	5.17	8.12	3.39

Table 12: Property SCstate2stateAp in GPAM with $K = 3$ and time interval [30, 60]

Target state	Main			OverallUsage			StackedBars			PeriodSelector			Stats		
	AP1	AP2	AP3	AP1	AP2	AP3	AP1	AP2	AP3	AP1	AP2	AP3	AP1	AP2	AP3
OverallUsage	3.01	86.76	47.71	0.00	0.00	0.00	4.95	88.86	48.85	127.24	98.58	48.73	4.83	—	29.07
StackedBars	43.07	3.81	11.53	44.62	5.11	15.65	0.00	0.00	0.00	167.51	14.87	12.55	46.14	—	15.78
PeriodSelector	221.85	38.15	13.36	223.40	39.45	17.47	221.20	40.94	14.90	0.00	0.00	0.00	224.92	—	17.61
Stats	23.48	—	173.20	20.52	—	125.49	25.41	—	174.34	147.03	—	174.22	0.00	—	0.00
UseStop	63.04	4.00	3.73	61.43	5.30	1.98	64.61	2.38	3.77	170.13	11.83	4.75	47.50	—	2.12

Table 13: Property SCstate2stateAp in GPAM with $K = 4$ and time interval [30, 60]

Target state	Main				OverallUsage				StackedBars				PeriodSelector				Stats			
	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4
OverallUsage	—	—	1.19	56.14	0.00	0.00	0.00	0.00	—	—	2.19	58.71	—	—	—	69.66	—	—	3.53	—
StackedBars	—	—	77.55	2.73	—	—	83.75	4.14	0.00	0.00	0.00	0.00	—	—	—	16.25	—	—	69.72	—
PeriodSelector	43.01	2.34	—	50.58	48.17	4.04	—	51.99	44.01	3.62	—	53.66	0.00	0.00	—	0.00	49.72	3.71	—	—
Stats	—	—	65.24	—	—	—	64.04	—	—	66.24	—	—	—	—	—	—	0.00	0.00	0.00	—
UseStop	—	—	77.76	3.20	—	—	76.57	4.59	—	78.76	1.06	—	—	—	—	11.65	4.70	—	58.40	—

Table 14: Property SState2stateAP in GPAM with $K = 5$ and time interval [30, 60]

Target state	Main					OverallUsage					StackedBars				
	AP1	AP2	AP3	AP4	AP5	AP1	AP2	AP3	AP4	AP5	AP1	AP2	AP3	AP4	AP5
OverallUsage	—	13.89	1.20	—	47.66	—	0.00	0.00	0.00	0.00	—	13.81	2.25	—	50.32
StackedBars	1.73	21.80	346.87	—	4.02	—	23.37	374.34	—	5.81	0.00	0.00	0.00	—	0.00
PeriodSelector	—	4.16	—	—	21.56	—	5.74	—	—	23.36	—	6.82	—	—	24.78
Stats	—	93.65	219.86	—	—	—	79.76	218.98	—	—	—	93.57	219.78	—	—
UseStop	3.21	29.45	964.09	—	3.93	—	31.03	967.12	4.83	5.63	2.77	7.65	950.77	—	1.09

Table 15: Property SState2stateAP in GPAM with $K = 5$ and time interval [30, 60]

Target state	PeriodSelector					Stats				
	AP1	AP2	AP3	AP4	AP5	AP1	AP2	AP3	AP4	AP5
OverallUsage	—	14.89	—	—	55.32	—	11.54	3.45	—	—
StackedBars	—	22.80	—	—	11.68	—	23.18	332.99	—	—
PeriodSelector	—	0.00	—	0.00	0.00	—	5.54	—	—	—
Stats	—	94.65	—	—	—	—	0.00	0.00	0.00	—
UseStop	—	30.45	—	—	7.46	—	30.83	772.74	9.55	—

Table 16: Property SCstate2stateAp in GPAM with $K = 2$ and time interval [60, 90]

Target state	Main		OverallUsage		StackedBars		PeriodSelector		Stats	
	AP1	AP2	AP1	AP2	AP1	AP2	AP1	AP2	AP1	AP2
OverallUsage	18.27	1.00	0.00	0.00	20.13	2.18	25.67	3.75	11.24	4.37
StackedBars	10.05	2267.84	11.96	2274.30	0.00	0.00	17.15	2271.08	12.86	2274.93
PeriodSelector	14.63	488.69	16.45	487.69	16.01	489.87	0.00	0.00	17.15	488.32
Stats	59.90	20.71	41.63	19.70	61.77	21.89	67.31	22.81	0.00	0.00
UseStop	7.29	4.60	9.18	3.59	6.03	5.78	11.27	2.60	10.06	4.22

Table 17: Property SCstate2stateAp in GPAM with $K = 3$ and time interval [60, 90]

Target state	Main			OverallUsage			StackedBars			PeriodSelector			Stats		
	AP1	AP2	AP3	AP1	AP2	AP3	AP1	AP2	AP3	AP1	AP2	AP3	AP1	AP2	AP3
OverallUsage	1.29	20.23	32.84	0.00	0.00	0.00	3.86	22.27	33.92	12.52	28.60	39.56	3.85	8.42	32.01
StackedBars	97.66	4.54	34.68	102.30	6.04	42.35	0.00	0.00	0.00	109.17	12.55	41.39	103.09	6.49	40.87
PeriodSelector	414.76	104.28	8.16	419.40	105.77	15.59	365.00	106.53	9.23	0.00	0.00	0.00	420.19	106.22	13.74
Stats	15.47	64.19	94.86	14.18	50.38	62.01	18.00	65.46	95.93	26.51	71.78	101.57	0.00	0.00	0.00
UseStop	3.70	3.52	12.30	2.50	5.01	19.86	5.25	2.92	13.27	10.10	9.23	13.11	3.20	5.46	18.21

Table 18: Property SCstate2stateAp in GPAM with $K = 4$ and time interval [60, 90]

Target state	Main				OverallUsage				StackedBars				PeriodSelector				Stats			
	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4	AP1	AP2	AP3	AP4
OverallUsage	—	4.95	1.45	33.85	0.00	0.00	0.00	0.00	—	5.95	3.82	34.85	—	—	12.52	40.74	—	5.98	3.19	32.55
StackedBars	—	2.26	72.05	31.08	—	3.72	76.14	39.49	0.00	0.00	0.00	0.00	—	—	83.12	37.97	—	4.90	77.37	37.85
PeriodSelector	—	—	216.68	8.90	—	—	220.76	16.99	—	—	193.96	9.90	0.00	—	0.00	0.00	—	—	222.00	14.95
Stats	—	34.08	18.43	86.97	—	29.13	16.97	53.11	—	35.08	20.80	87.97	—	—	29.49	93.86	0.00	0.00	0.00	0.00
UseStop	—	99.16	3.71	12.22	—	94.20	2.37	20.50	—	100.15	5.56	13.22	32.75	—	10.07	13.25	—	65.07	3.50	18.70

Table 19: Property SCstate2stateAp in GPAM with $K = 5$ and time interval [60, 90]

Target state	Main					OverallUsage					StackedBars				
	AP1	AP2	AP3	AP4	AP5	AP1	AP2	AP3	AP4	AP5	AP1	AP2	AP3	AP4	AP5
OverallUsage	1.64	1.03	—	8.59	49.92	0.00	0.00	0.00	0.00	0.00	4.23	—	—	—	51.84
StackedBars	17.64	—	—	—	11.81	19.28	—	—	—	21.31	0.00	—	0.00	—	0.00
PeriodSelector	37.18	11287.12	—	4.78	13.38	36.61	11286.10	—	6.14	22.55	34.73	—	—	—	15.30
Stats	10.08	32.30	—	41.55	177.10	8.65	31.26	—	32.95	127.19	11.47	—	—	—	—
UseStop	17.05	2.61	—	12.86	7.26	16.26	1.58	—	13.52	16.19	14.83	—	—	—	—

Table 20: Property SCstate2stateAp in GPAM with $K = 5$ and time interval [60, 90]

Target state	PeriodSelector					Stats				
	AP1	AP2	AP3	AP4	AP5	AP1	AP2	AP3	AP4	AP5
OverallUsage	10.97	3.39	—	9.41	56.86	4.52	4.24	2.71	8.95	47.60
StackedBars	23.00	—	—	—	18.02	19.75	—	—	—	19.75
PeriodSelector	0.00	0.00	0.00	0.00	0.00	33.40	11287.84	—	6.33	19.94
Stats	15.80	34.65	—	42.37	184.05	0.00	0.00	0.00	0.00	0.00
UseStop	11.83	1.86	—	9.64	10.43	12.69	3.34	—	11.39	14.83