Multi-Objective Reinforcement Learning Based Healthcare Expansion Planning Considering Pandemic Events

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APPENDIX

Table A.1: Average hospital admission per day for the 11 regions of Florida.

Year	2010		2011		2012		2013		2014		2015		2016		2017	
Reg.	Wkday	Wknd	Wkday	Wknd	Wkday	Wknd	Wkday	Wknd	Wkday	Wknd	Wkday	Wknd	Wkday	Wknd	Wkday	Wknd
1	281	161	283	165	283	171	281	173	281	180	284	177	291	182	295	194
2	252	145	256	147	255	150	250	148	250	157	260	165	256	164	265	171
3	723	439	724	443	736	463	727	472	748	497	756	496	766	508	788	525
4	787	489	805	496	805	507	810	521	838	555	866	580	871	581	877	581
5	607	383	611	385	613	400	602	406	607	424	642	457	661	459	655	461
6	946	589	947	598	951	617	946	627	966	651	1001	684	1018	685	1026	699
7	950	608	954	617	966	636	967	651	984	682	1000	694	1006	706	1013	704
8	619	364	616	370	615	376	607	383	628	396	639	408	638	402	645	411
9	792	495	800	510	803	523	804	537	837	562	855	573	857	586	852	584
10	720	479	706	473	698	477	695	480	700	486	717	494	717	499	703	494
11	1074	684	1081	697	1068	698	1065	703	1075	722	1080	714	1075	725	1047	696

Table A.2: Parameters for the experimental analysis.

General	Parameters	Neural Network
Number of regions, R=11	Reserved beds for pandemic scenario= 20%	Discount factor, γ= 0.99
Time Horizon, N= 30 years	Average hospital stay per admission= 4.7 days	Learning rate = 3e-4
4 age groups: Group-1: 0-18, Group-2: 18-44, Group-3: 44-65, Group-4: 65+ years.	Hospital Admission: Normal Dist. (μ = D. Tree predictor, σ^2= μ*0.2)	Actor Network Layers and Neuron 88-(12-120-48)-12
	Augmentation cost: Normal Distribution (μ = \$50 M, σ^2= \$3 M)	Critic Network Layers and Neuron 88-(12-120-48)-1
	Augmenting size, ΔH=120 bed	Optimizer= Adam

Available at https://github.com/Secure-and-Intelligent-Systems-Lab/MORL-Based-Healthcare-Expansion-Planning

Table A.2: Cost composition for the experimental analysis.

Estimation	Parameters	Estimation
DOS	No. of unattended patient for a region for a day, $\delta^r_{n,d}$	$\delta_n = \sum_{r=1}^{R} \sum_{d=1}^{D} \delta^r_{n,d}$
Investment cost	cost multiplier for augmenting 120 (=ΔH) bed: μ = \$50 M, σ^2= \$3 M	$E_n = \alpha_r = PPI^r_n \times \mathcal{N}(\mu, \sigma^2)$
DOS equivalent cost in [6]	cost multiplier for each unattended patient: β= \$0.04 M	DOS cost = β * δ_n