Reinforcement Learning Seminar

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SLIAR Optimal control

- Goal2 : SLIAR Multi-control
- Method : DQN

Mathematical models

- The influenza model : SEIAR model

$$
\begin{aligned}
S'(t) &= -\beta S(t)\Lambda(t) - \psi\nu(t)S(t) \\
E'(t) &= \beta S(t)\Lambda(t) - \kappa E(t) \\
I'(t) &= p\kappa E(t) - \alpha I(t) - \tau I(t) \\
A'(t) &= (1-p)\kappa E(t) - \eta A(t) \\
R'(t) &= f\alpha I(t) + \tau I(t) + \eta A(t) + \psi\nu(t)S(t) \\
&\text{with } \Lambda(t) = \epsilon E(t) + (1-q)I(t) + \delta A(t)
\end{aligned}
$$

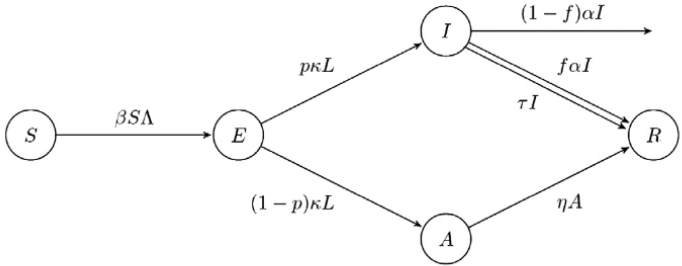

Fig. 1. Flow chart for the SEIAR model.

SEIAR model parameters

Parameter	Description	value
ϵ	Infectivity reduction factor for the exposed	0
q	Contact reduction by isolation	0.5
δ	Infectivity reduction factor for the asymptomatic	0.5
p	Fraction of developing symptoms	0.667
κ	Transition rate for the exposed	0.7143 / day
f	Complement to fatality rate (1 - fatality rate)	0.999
α	Recovery rate for the (symptomatic) infective	0.1667 /day
η	Recovery rate for the asymptomatic	0.1667 / day
τ	Antiviral treatment rate	0 / day
ψ	Efficacy of vaccination	70%
β	Transmission rate	*
R_0	Basic Reproduction number	1.9

- $\beta : \frac{R0}{(S0*((\epsilon/\kappa)+((1-q)p/\alpha)+(\delta*(1-p)/\eta))}$
- $S0 = 5e7, E0 = 0, I0 = 1, A0 = 0, R0 = 0$