

The Susceptible-Infected-Recovered (SIR) Model

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Background

- Kermack & McKendrick 1927
- Assumptions
 - Simple closed population & simple disease
- 3 population categories
 - **Susceptible (S)** - people who have not yet been infected
 - **Infected (I)** - currently sick and can transmit the disease to **Susceptibles**
 - **Recovered (R)** - individuals who have stopped being **Infected**

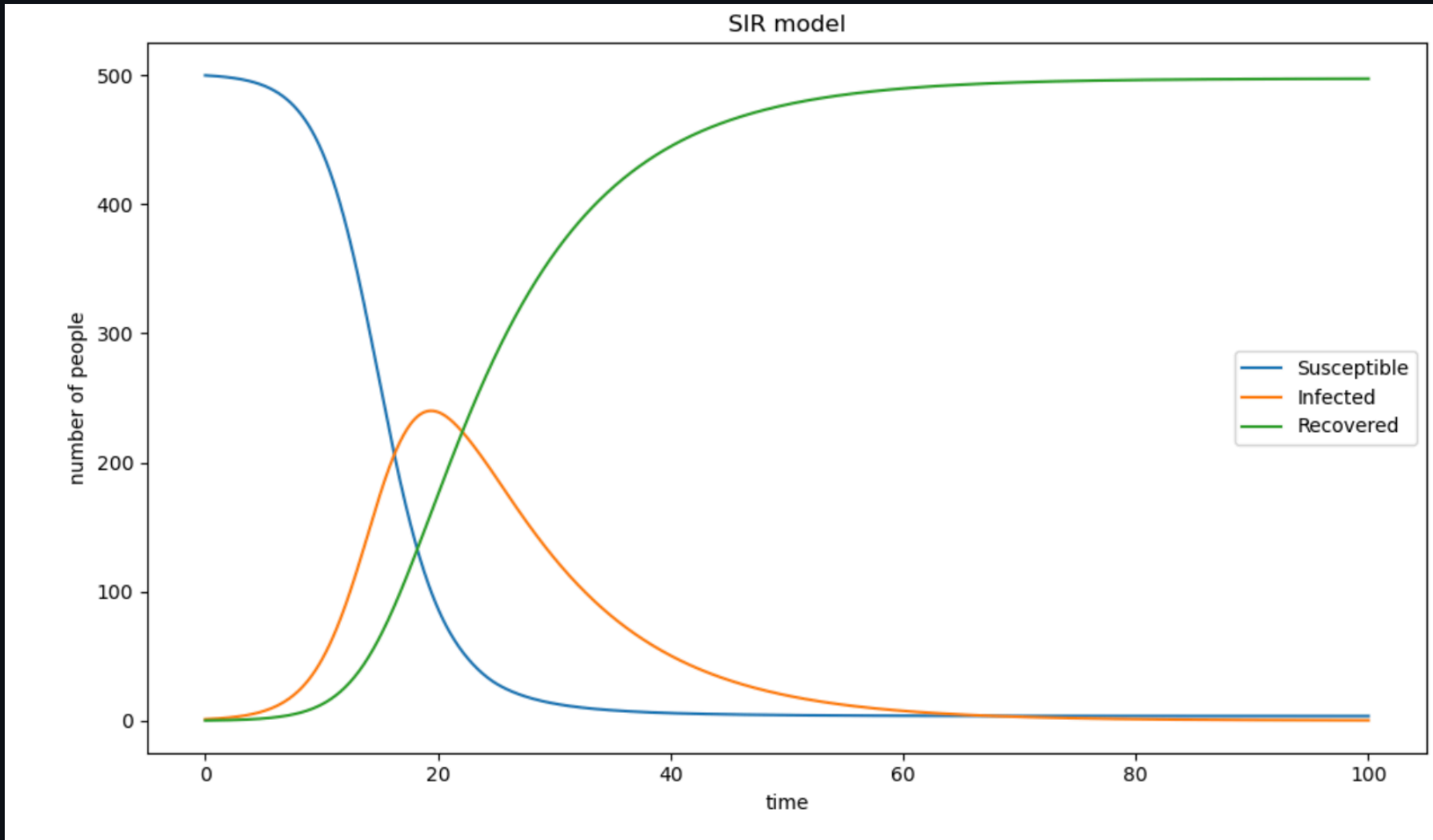
ODEs

$$\frac{dS}{dt} = -\frac{\beta}{N}SI$$

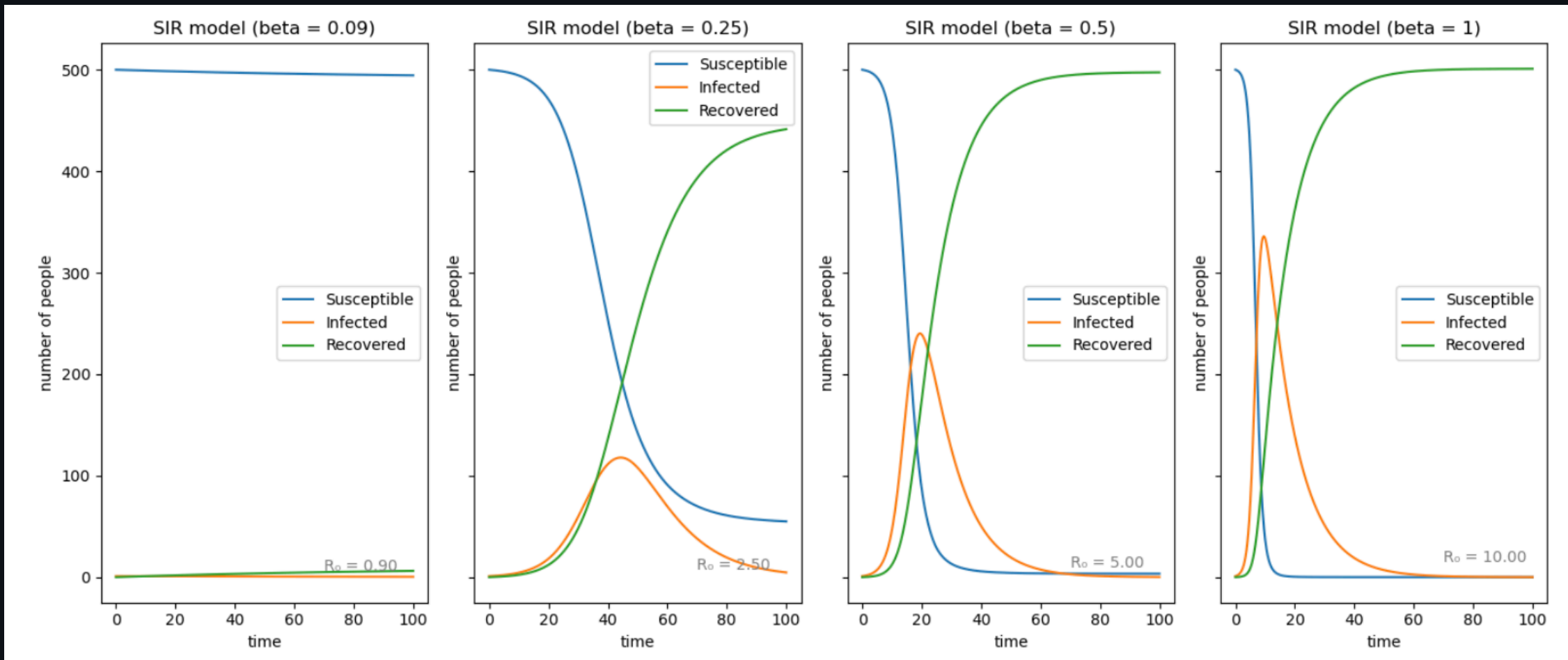
$$\frac{dI}{dt} = \frac{\beta}{N}SI - \gamma I$$

$$\frac{dR}{dt} = \gamma I$$

SIR Dynamics



What happens if we change β ?



R_0 (not to be confused with $R(0)$)

$$R_0 = \frac{\beta}{\gamma}$$

$R_0 > 1$ describes an outbreak/epidemic.

Limitations and extensions of the classical SIR model

- SEIRS model - latency and temporary immunity (Bjornstad et. al. 2020)
- localized networks
- stochastic effects

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