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Epidemiological Modelling of Misinformation with Optimal Intervention Strategies

Fake news poses an increasingly critical threat to societal stability by shaping opinions, eroding institutional trust and deepening social polarisation. Every day, misleading content circulates across digital platforms with real consequences such as political manipulation.

Due to the resemblance of the spread of fake news with the transmission of infectious diseases, epidemiological frameworks, specifically the Susceptible-Infected-Recovered (SIR) model, are considered well suited to analyse its dynamics. In this work optimal control theory is applied in order to curb the propagation of false information. The cost functional is defined by two weights: one that penalises the overall number of users who have been mislead - to capture the social cost of the fake news - and another to quantify the economic and/or operational cost associated with the control action itself (e.g. content moderation).

SIR parameters (infection and recovery rates) are estimated by fitting the model to real-world fake-news data. By combining least-squares technique and a derivative-free optimisation algorithm in MATLAB, the optimal parameters that best describe the specific false information spread are obtained. The Forward-Backward-Sweep Method (FBSM) is then applied to compute the optimal control strategy, or intervention, aimed at minimising the number of misinformed individuals while balancing social harm against intervention cost.

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