ImageNet pretraining for medical image segmentation: Enhancing efficiency via transferability metrics

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In medical image segmentation tasks, the scarcity of labeled training data poses a significant challenge when training deep neural networks. When using U-Net-style architectures, it is common practice to address this problem by pretraining the encoder part on a large general-purpose dataset like ImageNet. However, these methods are resource-intensive and do not guarantee improved performance on the downstream task. In this paper we investigate a variety of training setups on medical image segmentation datasets, using ImageNet-pretrained models. By examining over 300 combinations of models, datasets, and training methods, we find that shorter pretraining often leads to better results on the downstream task, proving that the accuracy of the model on ImageNet is a poor indicator for downstream performance. As our main contribution, we apply a contrastive transferability score between ImageNet and the downstream dataset to indicate when to stop pretraining. This reduces pretraining time and improves results on the target task.

Threshold dynamics in a periodic epidemic model with imperfect interventions

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A non-autonomous mathematical model is presented to explore the complex dynamics of disease spread over time, incorporating a time-periodic transmission parameter and imperfections in quarantine, isolation and vaccination strategies. Through a detailed examination of threshold dynamics, it is revealed that the global dynamics of disease transmission are influenced by the basic reproduction number ($\mathcal{R}_0$), a critical threshold that determines extinction, persistence, and the presence of periodic solutions. It is shown that the disease-free equilibrium is globally asymptotically stable if $\mathcal{R}_0 < 1$, while the disease persists if $\mathcal{R}_0 > 1$. To support and validate our analytical results, the basic reproduction number and the dynamics of the disease are estimated by fitting monthly data from two Asian countries, namely Saudi Arabia and Pakistan. Furthermore, a sensitivity analysis of the

time-averaged reproduction number ($\langle \mathcal{R}_0 \rangle$) of the associated time-varying model showed a significant sensitivity to key parameters such as infection rates, quarantine rate, vaccine coverage rate, and recovery rates, supported by numerical simulations. These simulations validate theoretical findings and explore the impact of seasonal contact rate, imperfect quarantine, isolation, imperfect vaccination, and other parameters on the dynamics of measles transmission. The results show that increasing the rate of immunization, improving vaccine management, and raising public awareness can reduce the incidence of the epidemic. The study highlights the importance of understanding these patterns to prevent future periodic epidemics.

Acknowledgment: This research was completed in the National Laboratory for Health Security RRF-2.3.1-21-2022-00006. This research was completed in the National Laboratory for Health Security RRF-2.3.1-21-2022-00006. M.A.I. was supported by the Hungarian National Research, Development and Innovation office grant NKFIH PD_23 146210.

Malaria dynamics with bimodality of incubation period in hosts in a seasonal environment

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To describe the bimodal distribution of the incubation time of *P. vivax* malaria in Korea corresponding to empirical observations, we present a periodic compartmental model of delay differential equations for malaria transmission dynamics with two distinct exposed classes in the human population and including time-dependent parameters for mosquito birth and death rates as well as biting rates. The short-term incubation period is modelled by exponential distribution, while the long-term incubation is assumed to be of fixed length. We identify the basic reproduction number as the spectral radius of a linear operator and show that it is a threshold parameter for the global dynamics of the model. We apply the model to data from South Korea.

Acknowledgment: This research was completed in the National Laboratory for Health Security RRF-2.3.1-21-2022-00006. This research was completed in the National Laboratory for Health Security RRF-2.3.1-21-2022-00006. M.A.I. was supported by the Hungarian National Research, Development and Innovation office grant NKFIH PD_23 146210.