

Dynamic group testing to control and monitor disease progression in a population

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Abstract—In this paper, we introduce a “discrete-time SIR stochastic block model” that also allows for group testing and interventions on a daily basis. Our model can be regarded as a discrete version of the well-known continuous-time SIR stochastic network model [1] and relies on a specific type of weighted graph to capture the underlying community spread. Given that infection model, we then formulate a dynamic group-testing problem by asking: (a) what is the minimum number of tests needed everyday to identify all infections? and (b) are there nonadaptive group testing strategies that achieve this with vanishing error probability? Our results show that one can leverage the knowledge of the community infection model to compute a lower bound on the number of tests and also inform

do not account for the time dynamics of a disease spread. To the best of our knowledge, our work in [28] was the first paper that targeted community-aware, group-test design for the dynamic case. In that work we used the well-established continuous-time SIR stochastic network model in [1], where individuals are regarded as the vertices of a graph $\mathcal{G}$ and an edge denotes a contact between neighboring vertices, and we explored group testing strategies that were able to track the epidemic state evolution at an individual level. Though we did consider testing delays, we left interventions for future work.

In this paper¹, we allow testing and interventions through