Machine Learning for Infectious Disease Risk Prediction

Multi-level Taxonomy

Pandemic and Epidemic Phases

Intrinsic and Complex Transmission Patterns of Disease

- Spatiotemporal Dependency Mining

Gap between Epidemiological Interpretation and Computational Modeling

- Epidemiological Parameterization
- Epidemiology-embedded Learning

Lack of Epidemiological Information and Disease-related Data

- Enhancement of Data and Information Completeness
- Knowledge Transfer between Similar Disease Patterns

Endemic and Elimination Phases

Localized Disease Transmission Patterns

- Temporal Autocorrelation Modeling
- Correlated Signals of Disease Dynamics

Specific Challenges in Disease Elimination

- Imported Risk Modeling
- Limited Resource Management for Surveillance

Technical Challenges

Data

Multiple Modalities

Multi-source Time-series Data
Time-series Data with Textual Data
Time-series Data with Biomedical Data

Multiple Resolutions

Same, Fine, and Coarse Scales with Predicted Variables

Task

Distribution Shift

Data Distribution Shift
Parameter Distribution Shift

Uncertainty Quantification

Probabilistic Modeling
Uncertainty-aware Deep Learning

Model and Prediction Robustness

Stacking Technique
Result Ensemble
Bootstrapping Sampling

Model Interpretability

Model Structure
Temporal Similarity

Evaluation

Measurements of Disease Severity

Disease Incidence
Case Numbers
Death Counts

Patient Visit Counts
Disease Activity Levels

Evaluations of Model Performance

Point Estimation
Interval Estimation