LOMT - Laboratory Optimizer for Mass Testing

Scaling up COVID-19 mass screening: Improving the performance of medical laboratories and reducing the cost and time of testing

Laboratory Optimizer for Mass Testing (LOMT) is open source software for the management of COVID-19 pool testing. It allows the testing of 2 to 30 times more people with the existing resources of a laboratory by reducing the quantity of assays, reagents and time spent on each test.

Applicability

- Qualitative test of the presence of a single target component — i.e., SARS-CoV-2 RNA
- PCR and other techniques that allow mixing several specimens into an assay
- A large number of single-type tests (>100) with a prevalence below 20%

Use cases

- Frequent screening of high-risk groups or those involved in human interaction activities — medical staff, teachers and students, public services, company employees
- Epidemiological surveillance of the population to monitor the general infectious state, early detection of infected people and localization of foci of infection

Technology

In the pool-testing method, the analysis process of a laboratory remains the same as in standard individual testing. The difference concerns only the analyte; instead of analyzing an individual specimen, a mixture of several specimens — a pool — is analyzed.

The program is a tool for laboratory personnel. It designs the specimen mixing plan, tracks specimens and assays, and decodes the results of assays completed into the results of specimens.

LOMT supports several pool-testing algorithms and strategies, from plain grouping of samples into pools to more complex algorithms with binary search, combinatorial analysis and probability analysis, and it suggests the optimal strategies depending on the prevalence, optimization task and operational constraints.

The program offers a user-friendly visual guide for manual specimen pipetting and result reporting, and can be integrated with the laboratory information system and laboratory robotics.

Efficiency

LOMT supports several different pooling strategies and automatically searches for the optimal strategy for every specific condition of a laboratory – prevalence, constraints of testing and priorities of optimization.

For a high prevalence (10%) and the maximum pool size 8, the maximum reduction of the number of assays is 2.1x compared to the individual testing: for a batch of 1000 specimens the pool testing uses 477 assays on average, while the individual testing uses 1000 assays. For a medium prevalence (1%) and the maximum pool size 32, the maximum reduction of the number of assays is 11x, with 90 assays on avarage for a batch of 1000 specimens. For a low prevalence (0.1%) and the maximum pool size 32, the maximum reduction of the number of assays is 25x, with 39 assays on average for a batch of 1000 specimens.

Prevalence	Specimens	Pool size	Assays	Reduction
10%	1000	8	477	2.1
1%	1000	32	90	11.1
0.1%	1000	32	39	25.6

More information is available in "The brief comparison of the operational efficiency of pool-testing strategies for COVID-19 mass testing in PCR laboratories."

Requirements

Cloud application

LOMT is implemented as a cloud application with a graphical user interface running on a web browser without installation on any desktop computer, laptop or tablet. It can be also installed in a laboratory or within the IT infrastructure of an enterprise for large-scale deployment.

The program is also available at Microsoft Azure and Amazon Web Services.

API service

LOMT is also available as an API service that can be used in software developed by LIS/LIMS vendors and laboratory equipment vendors. The service can be accessed by HTTPS/JSON over the Internet or virtual private networks in major public clouds.

References

1. Idan Yelin et al, Evaluation of COVID-19 RT-qPCR test in multi-sample pools, Clinical Infectious Diseases
2. Stefan Lohse et al, Pooling of samples for testing for SARS-CoV-2 in asymptomatic people
3. Haran Shani-Narkiss etc al, Efficient and Practical Sample Pooling for High-Throughput PCR Diagnosis of COVID-19