INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Vaxign-ML: Supervised Machine Learning Reverse Vaccinology Model for Improved Prediction of Protective Antigens

TECHNOLOGY NUMBER: 2021-369

OVERVIEW

Vaxign-ML is an advanced machine learning platform that accelerates and improves the identification of bacterial protective antigens, streamlining the rational design of vaccines.

- Integrates both biological and physicochemical data for far more accurate vaccine candidate prediction than existing solutions.
- Accessible via user-friendly web and standalone interfaces, removing technical barriers for a wider base of vaccine developers and biotech teams.

BACKGROUND

Vaccine design is a vital public health field, but creating effective vaccines—especially against complex or emerging bacteria—remains highly challenging. Conventional computational tools for “reverse vaccinology” (RV) analyze pathogen genomes to predict which proteins could be protective antigens (key to vaccine success), but often lack accuracy and rely on limited data types. Recent interest in machine learning (ML) has led to better RV tools, but these are still hampered by narrow feature sets and technical inaccessibility. With infectious disease threats rising, there’s a pressing demand for accessible, accurate, and scalable vaccine candidate discovery tools as vaccine R&D intensifies globally.

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Category
Software
Software & Content
MOSS - Michigan Open Source Support

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INNOVATION

Vaxign-ML employs a supervised ML approach, rigorously trained on both biological characteristics and physicochemical properties from experimentally validated datasets. Multiple ML algorithms were evaluated—using robust, unbiased validation strategies—culminating in a final model based on eXtreme Gradient Boosting. This model outperformed all existing public tools, accurately ranking proteins by their likelihood to elicit protective immunity (so-called "protegenicity"). Vaxign-ML's dual-interface system (public web server and Docker container) makes high-performance RV predictions accessible to technical and non-technical users alike, significantly lowering the barrier to entry for modern vaccine design.

ADDITIONAL INFORMATION

PROJECT LINKS:

- http://www.violinet.org/vaxign2/vaxign-ml
- https://hub.docker.com/r/e4ong1031/vaxign-ml
- https://github.com/VIOLINet/Vaxign-ML-docker