



AI-Powered Full-Pregnancy Prediction Model for Pregnancy Outcomes in RSA Patients Undergoing ART: Construction and Clinical Application



01

Develop accurate, generalizable, and interpretable prediction models for a wide range of pregnancy outcomes in RSA patients undergoing ART.

- Integrate comprehensive multidimensional data: demographics, reproductive history, metabolic/endocrine profiles, genetics (where available), lifestyle factors, treatment details (ovarian stimulation, embryo quality, etc.), and laboratory test results from three tertiary centers.
- Employ and compare state-of-the-art machine learning algorithms (e.g., XGBoost, LightGBM, random forest, neural networks, logistic regression) and ensemble strategies to model outcomes including live birth, miscarriage, preterm birth, hypertensive disorders, GDM, delivery mode, etc.
- Perform rigorous model validation: internal (k-fold cross-validation, bootstrap), external (temporal and center-level validation), and calibration assessment; provide model interpretability via SHAP, partial dependence plots, and feature importance analysis.
- Evaluate clinical utility through decision curve analysis to ensure models are both accurate and clinically actionable.



02

Establish an AI-based platform suitable for integrated health service networks, enabling secure data sharing and consistent result recognition across institutions.

- Build a unified data standard and ontology for obstetrics and ART, with standardized coding (ICD-10, SNOMED CT, LOINC) and variable dictionary.
- Develop a modular, scalable, and interoperable platform based on microservice architecture and API interfaces to support multi-center data exchange, model deployment, and version management.
- Implement data governance and quality control: data completeness, consistency, outlier detection, and automated quality monitoring.
- Strengthen data security and privacy: role-based access control, encryption, audit logging, and compliance with regulations.



03

Build a three-level, full-cycle integrated management pathway and a people-centered closed-loop care model.

- Cover the full pregnancy continuum: preconception counseling and risk assessment → pregnancy monitoring and management → delivery planning and care → postpartum follow-up and long-term health management.
- Provide individualized risk stratification and dynamic prediction updates at key time points (pre-embryo transfer, early pregnancy, mid-pregnancy, late pregnancy, postpartum).
- Enable closed-loop management: "risk prediction → clinical intervention → outcome evaluation → model re-optimization" to continuously improve care quality and outcomes.
- Support multidisciplinary collaboration among reproductive specialists, obstetricians, endocrinologists, geneticists, nutritionists, and primary care.

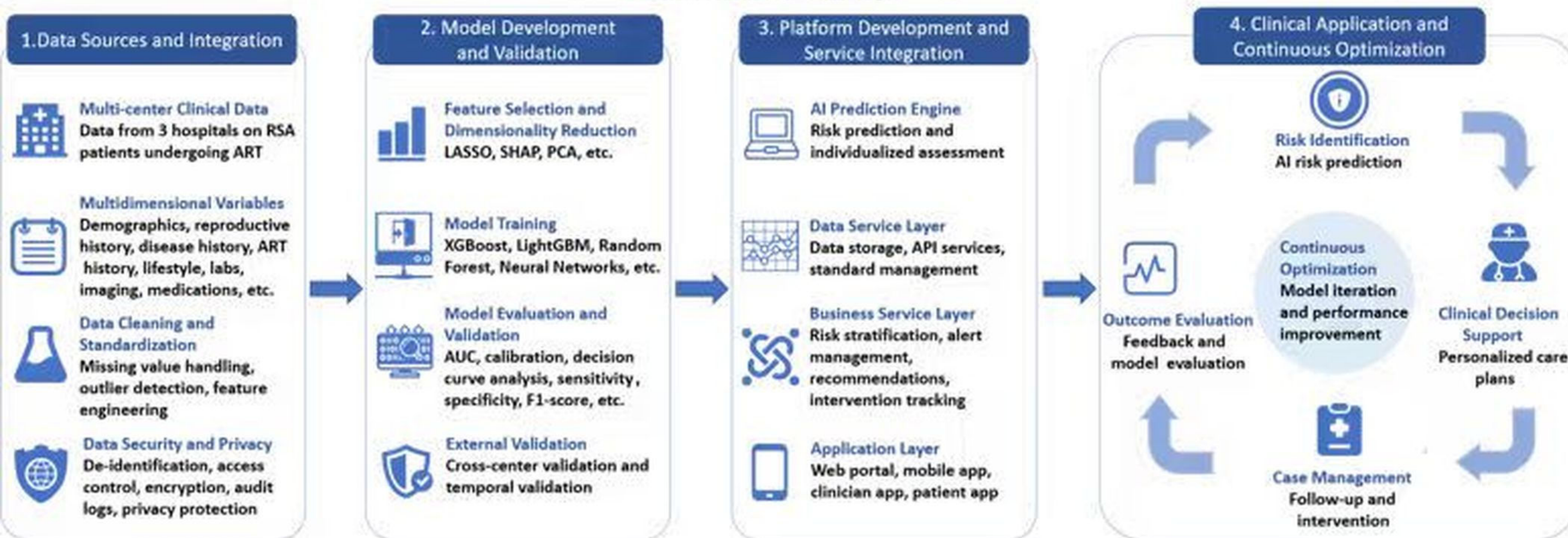


04

Reduce adverse pregnancy outcomes and improve maternal and neonatal health.

- Enable early identification of high-risk patients and precise interventions (e.g., medication adjustment, lifestyle modification, specialized monitoring) to reduce miscarriage, preterm birth, GDM, hypertensive disorders, and other complications.
- Support evidence-based, standardized clinical decision-making and resource allocation.
- Improve maternal and neonatal outcomes, enhance patient satisfaction and experience, and reduce healthcare costs and disputes.
- Generate real-world evidence to support guideline development and health policy decision-making.

TECHNICAL ROADMAP



Ultimate Goal

Build an interpretable, scalable, and deployable AI prediction model and integrated service network to achieve full-cycle health management for RSA patients undergoing ART, reduce adverse outcomes, and promote healthy pregnancies and maternal and neonatal well-being.

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