

Healthcare's Data Science Platform

Getting the right answers starts with the right platform. ClosedLoop's data science platform combines leading-edge AI tools and automation capabilities with healthcare specific content and expertise enabling healthcare data scientists to build accurate and explainable predictive models with speed and ease.

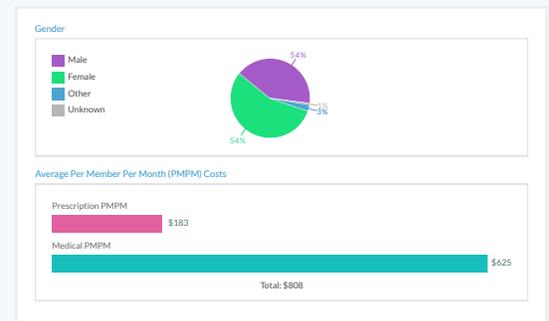
HERE'S HOW CLOSEDLOOP'S AI-POWERED PLATFORM IS HELPING ORGANIZATIONS REDEFINE HOW DATA SCIENCE MOVES HEALTHCARE FORWARD.

Easily Handle Messy Healthcare Data

Healthcare data is notoriously "messy." ClosedLoop makes it simple to import raw healthcare data sets, such as medical claims, prescriptions, EMR, and custom data, without the need for tedious data normalization and cleansing. Data handling capabilities include:

- HIPAA-compliant storage and data access
- Support for fixed snapshots and streaming data
- Automated data dictionary creation
- Auto-detection of data types
- Auto-clean support for common healthcare elements including diagnosis, procedure, and drug codes
- Support for all major coding systems (ICD 9/10, CPT, HCPCS, NDC, NPI, and SNOMED)
- Auto-generated summary statistics, e.g. per member per month cost, age and gender summary, etc.
- Automated quality checks for imported data

Auto-generated summary statistics



Prebuilt Features

- Comorbidities
- Drug interactions
- Medical cost patterns
- Admissions
- Visit counts
- Medication adherence
- Charlson Comorbidity Index
- Preventative Services Index
- LACE
- APACHE
- HCC
- CDPS
- USDA Food Environment Atlas
- CDC Behavioral Risk Factors
- Area Deprivation Index
- County Health Rankings

Automate Feature Engineering

After data cleansing, feature engineering is one of the most expensive and time-consuming aspects of data science. ClosedLoop helps healthcare data scientists build models and features smarter and faster—freeing them to focus their time on discovery of new insights. Automated feature engineering capabilities include:

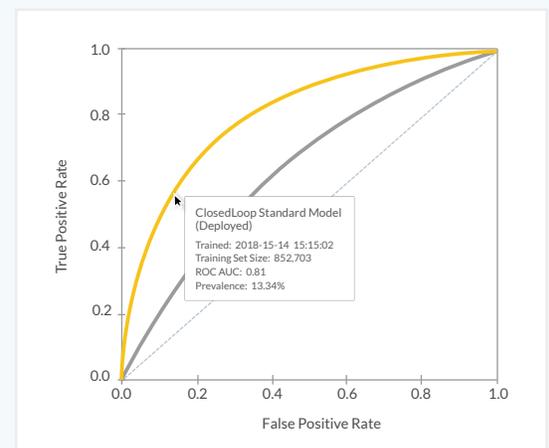
- Over 800 prebuilt healthcare specific features
- Automatic mappings to licensed ontologies (GPI, RxNorm, CCS, BETOS, UMLS, and FHIR)
- Support for complex combinations of events, e.g. initiation of metformin within 60 days of an initial diabetes diagnosis
- Built-in support for social factors including USDA Food Environment Atlas, CDC Behavioral Risk Factors, Area Deprivation Index, and County Health Rankings
- Custom feature generators for incorporating novel and proprietary data sources
- Fully automated model training and evaluation process

Increase Accuracy

Artificial Intelligence, machine learning, and predictive analytics are just buzz words if they don't change behaviors and workflows. To gain trust and drive adoption, models must be highly accurate and always improving. ClosedLoop provides data scientists with the tools they need to build highly accurate models and to continuously improve those models as new data and insights are surfaced. The following are just a few of ClosedLoop's capabilities that directly drive accuracy in healthcare predictive models:

- Baseline model creation using automated features for any prediction in less than 24 hours
- Custom population and outcome definition to precisely tailor models
- Natural language processing to extract SNOMED terms from free-text notes
- Advanced machine learning algorithms utilizing neural network and tree-based ensemble methods
- Automated model tuning utilizing hyperparameter optimization and cross-validation
- Local population training support increases accuracy vs. pre-trained models
- Cross-training support leveraging licensed external data
- Model versioning to enable testing of new features and accuracy comparison
- Automated accuracy reporting including ROC and precision/recall curves, model calibration plots, and train and test set performance

ED Utilization | ROC curve comparison for model versions

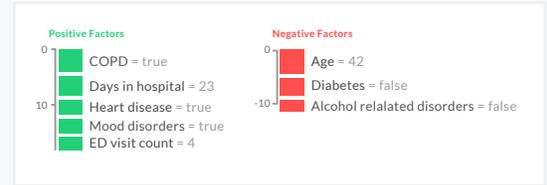


Enhance Explainability

Healthcare practitioners demand that predictive models not only be accurate, they must also be explainable. ClosedLoop unpacks the "black box" of artificial intelligence allowing data scientists and clinicians to understand why and how factors impact a model's prediction, driving faster adoption and better clinical results. Capabilities include:

- Auto-computed top factors show which variables matter most across an entire population
- Weighted positive and negative factors for individual patients inform clinical and operational workflows
- Prediction trends over time show changes in risk for any given outcome as new data is received
- Factor visualizations help users understand the important factors underlying any prediction

Admission Risk | Weighted positive and negative factors



Support Collaboration

Teamwork and collaboration lead to better outcomes. Yet, in traditional data science roles, data and code are often siloed to individual contributors. To create a community of excellence and foster innovation, data science should be a team sport. ClosedLoop allows data scientists and clinicians to create and iterate on predictive models together. Collaboration capabilities include:

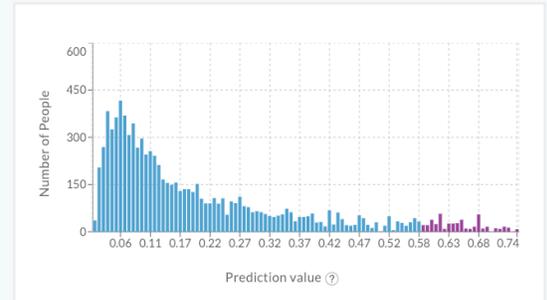
- Easy-to-use feature language understandable by data scientists and clinicians
- Feature and model catalogs support reuse of best practices
- Version-controlled repositories with data provenance tie predictions to the exact data and model that created them
- Easily understood visualizations for model accuracy, feature importance, and prediction results
- Straightforward model comparison supports iteration and testing of new features
- Python and REST APIs for easy integration with Jupyter notebooks and other data science tools

Enable Seamless Model Deployment

Once a model is trained and reviewed by stakeholders, data scientists often have the challenging job of figuring out how to make the model work in production. With ClosedLoop's end-to-end solutions, it is easy to operationalize a model and automatically update predictions as new data arrives. Deployment capabilities include:

- Pushbutton deployment puts new models into production with a single click
- Automatic update of predictions as new data streams in
- Built-in error handling for schema changes and data anomalies
- Automated quality checks on new predictions
- REST API or push notifications to retrieve predictions
- Model performance monitoring over time

Readmission Risk | Population stratification



What Matters Most

Healthcare data is powerful but only if it is accessible and easy to understand—for all stakeholders. Whether you are a CTO, data scientist, or clinician, ClosedLoop's proven data science platform not only helps answer the most challenging questions, it frees up valuable time so you can focus on the work that matters most—changing lives for the better. Learn more at www.closedloop.ai.