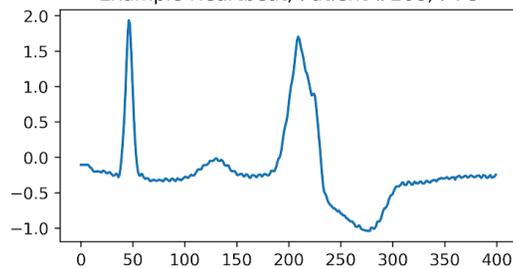# CLASSIFYING USING MACHINE LEARNING

CHALLENGE

CLASSIFYING HEARTBEATS

When the heart beats irregularly, it is known as an arrhythmia. A common heart arrhythmia, known as **premature ventricular contraction** (PVC), accounts for the highest number of non-actionable and false-positive in-hospital patient monitoring alarms. Current in-hospital patient monitoring systems do not have the capabilities to discern true-PVC alarms from false-alarms, and therefore **medical professionals experience alarm fatigue**, a desensitization to alarms leading to lower quality of care. This presents an opportunity to apply sophisticated machine learning methods to improve the accuracy of these alarms.

Example Heartbeat, Patient #208, PVC

ACTIONS & RESULTS

MACHINE LEARNING

Our team explored several machine learning approaches to handle and **classify electrocardiogram (ECG) signal data** from two data sets: the famous MIT-BIH Arrhythmia labeled data set, and UC San Francisco's massive unlabeled data set. The MIT-BIH Arrhythmia Database has 48 records of half-hour ECG signals that we sliced into 10-seconds ECG signal strips, 5-seconds before and 5-seconds after each annotated beat.

LOGISTIC REGRESSION, RANDOM FOREST, AND NEURAL NETWORKS

Using a data set of 7099 PVC alarms, and 7099 non-PVC records derived from the full MIT-BIH data set, Logistic Regression, Random Forest, and a Neural Network was trained.

MODEL	ACCURACY	TRUE POSITIVE RATE	FALSE POSITIVE RATE
Baseline	50.33%	0.00%	0.00%
Logistic Regression	76.01%	75.51%	23.49%
Random Forest	77.86%	56.48%	0.47%
Neural Network	92.23%	90.56%	6.10%

TSNE, K-MEANS CLUSTERING, AND TRANSFER LEARNING

T-distributed stochastic neighbor embedding (TSNE) attempts to preserve high dimensional neighborhoods using a probabilistic interpretation of transformed data (Left). Anomaly detection with K-Means clustering algorithms can be used for QRS complex detection in time series ECG signal data (Center). Transfer Learning using one of Google's pre-trained models can lead to improved heart beat classification (Right).

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