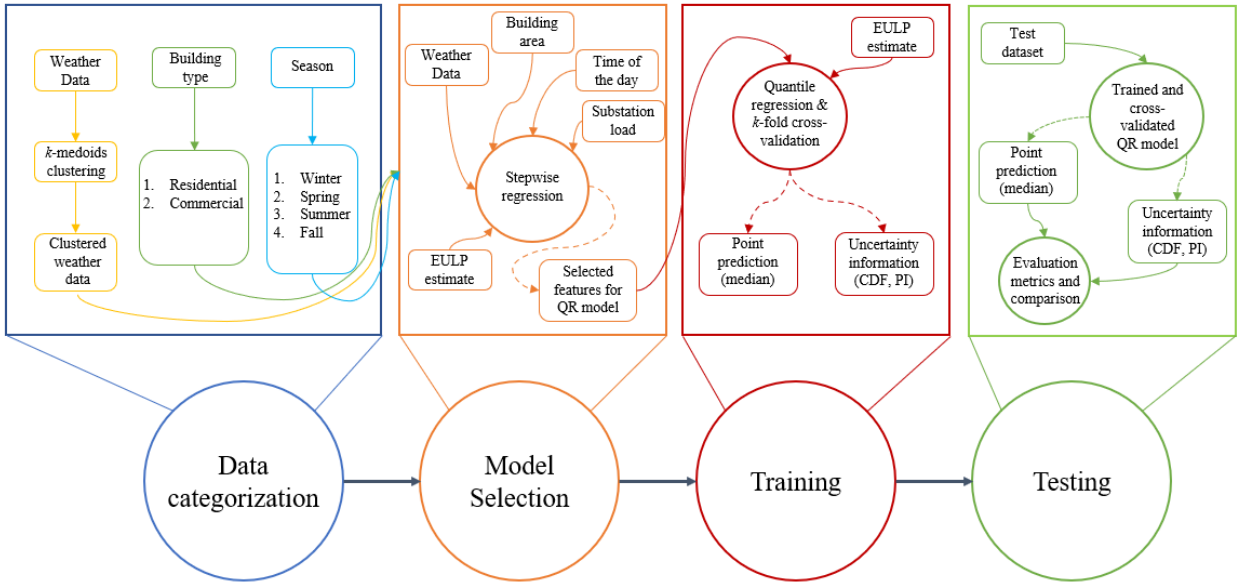
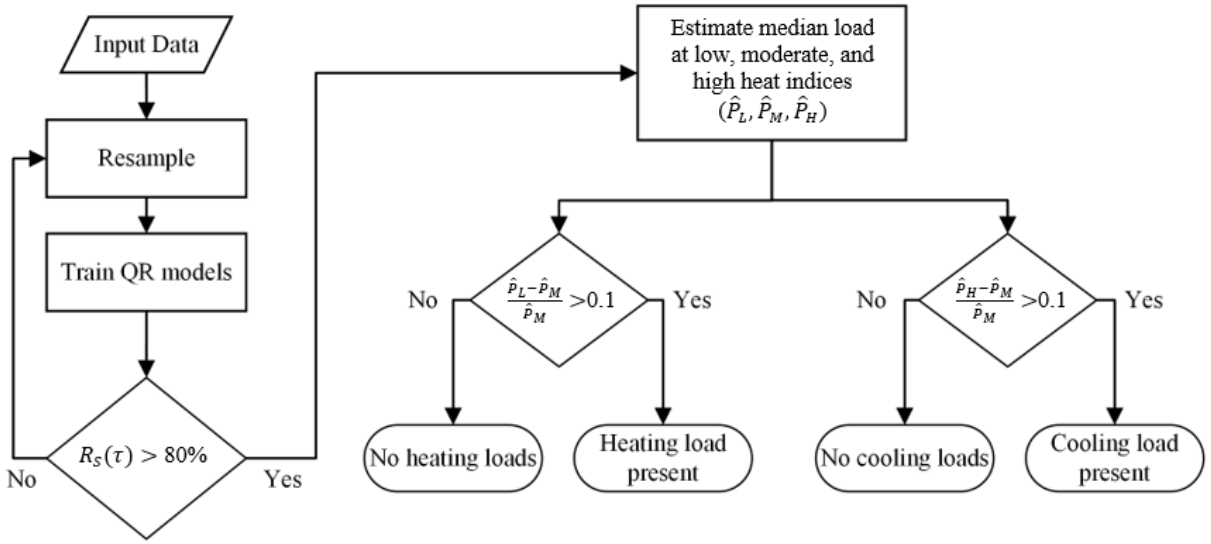
Quantile Regression based Adaptive Modeling (QRAM)



QRAM performs following steps to estimate load consumption under varying weather conditions:

- ✓ Data categorization based on weather condition, building type, and seasonal variation
- ✓ Performs stepwise regression to select highly-correlated predictors
- ✓ Trains quantile regression (QR) models to estimate load consumption and associated uncertainty information by means of predictive distributions and confidence intervals
- ✓ Performance evaluation based on suitable evaluation metrics
- ✓ Inputs:
  - Predictors: Weather variables, building information, time of day
  - Response: End-use load profiles (for building and feeder level loads), Substation load data (for substation level loads)
- ✓ Outputs:
  - Building, feeder, and substation level loads

Given proper datasets, QRAM can be extended to different climate regions.



QRAM couples QR and a sensitivity analysis method to estimate electrification

- ✓ QR models' sensitivity to "heat index" is leveraged
- ✓ "Heat index" is varied in its entire range while other predictors' variability in the QR model is limited
- ✓ For each building, median loads at low, moderate, and high heat index are predicted
- ✓ Comparing median load at low/high heat index with the median load at moderate heat index, a decision is made on the presence of heating/cooling loads at the building (see flowchart above)
- ✓ After repeating these steps for each building in a substation, the percentage of buildings having heating/cooling loads are determined

QRAM will generate future electrification scenarios based on electrification level, renewable penetration, and demand-side flexibility under extreme weather conditions to estimate future peak demand. The number of scenarios are dependent on data availability.