5450 Project Techniques Checklist

Datasets:

Data acquisition -> cleaning -> wrangling -> integration -> feature extraction -> models -> evaluation

(Note: This is a concept list for 5450. We don’t need all. Just enter “v” on selected methods, or “x” on unwanted methods, or add comments)

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| --- | --- | --- | --- | --- | --- |
| Name&Date |  |  |  |  |  |
|  |  |  |  |  |  |
| ***Data formats:*** |  |  |  |  |  |
| Numerical independent data |  |  |  |  |  |
| Categorical independent data |  |  |  |  |  |
| Time series data |  |  |  |  |  |
| Text data |  |  |  |  |  |
|  |  |  |  |  |  |
| ***Techniques:*** |  |  |  |  |  |
| *Data acquisition:* |  |  |  |  |  |
| Web crawling? |  |  |  |  |  |
| Info retrieval: gather dataset through API? |  |  |  |  |  |
| *Structured, clean, integrated data:* |  |  |  |  |  |
| Pandas |  |  |  |  |  |
|  |  |  |  |  |  |
| Store in RDMS or NoSQL? (tables? Arrays? Nested? ) |  |  |  |  |  |
| Storage/updates/queries database |  |  |  |  |  |
| Split hierarchical data when not 1:1 |  |  |  |  |  |
| PandaSQL? SQLite? |  |  |  |  |  |
| Transactions? Concurrency control? |  |  |  |  |  |
|  |  |  |  |  |  |
| Knowledge Representation, ER Diagrams |  |  |  |  |  |
| knowledge graph |  |  |  |  |  |
| Normal forms (1st, 2nd, 3rd, Boyce-Codd) at least should be 1st for tables |  |  |  |  |  |
| Record linking |  |  |  |  |  |
| Data validation (rules/master list) |  |  |  |  |  |
| NLP:  Remove Unwanted Characters -> Expand Contractions & Lowercase |  |  |  |  |  |
| Time series: resampling (downsampling/upsampling) |  |  |  |  |  |
|  |  |  |  |  |  |
| *Optimization for big data:* |  |  |  |  |  |
| Optimizing relational algebra: push down early, indexing, sharding |  |  |  |  |  |
| Optimizing join orders |  |  |  |  |  |
| Algorithmic techniques: index, buffers/blocks |  |  |  |  |  |
|  |  |  |  |  |  |
| *Extract features:* |  |  |  |  |  |
| Dask? |  |  |  |  |  |
| Spark? (minimize repartition: groupby&JOIN; persist()) |  |  |  |  |  |
| AWS cloud? |  |  |  |  |  |
|  |  |  |  |  |  |
| Visualizations |  |  |  |  |  |
| Vis Time series: grouping; binning; rolling statistics |  |  |  |  |  |
|  |  |  |  |  |  |
| One-hot encoding |  |  |  |  |  |
| Text: word embedding |  |  |  |  |  |
| Text: Parts of Speech |  |  |  |  |  |
| Text: identify named entities |  |  |  |  |  |
| Text: entity resolution, co-reference resolution, relation extraction |  |  |  |  |  |
|  |  |  |  |  |  |
| Encoding for feeding to NN |  |  |  |  |  |
|  |  |  |  |  |  |
| Subset selection / forward selection / backward selection / PCA / t-SNE before supervised ML |  |  |  |  |  |
| Before classification: clustering |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| *Descriptive/Inferential model:* |  |  |  |  |  |
| Parametric models (linear regression, logistic regression, …) better for inference |  |  |  |  |  |
| Hypothesis testing (test stats? )  Bonferroni Correction |  |  |  |  |  |
|  |  |  |  |  |  |
| Time series: Checking for Stationarity: Augmented Dickey-Fuller (ADF); remove trends using moving averages (especially  EWMA); Deseasonalizing by Decomposition |  |  |  |  |  |
| Time series: Forecasting with ARIMA |  |  |  |  |  |
|  |  |  |  |  |  |
| Train/validation/test splitting |  |  |  |  |  |
| PyTorch or Keras? |  |  |  |  |  |
|  |  |  |  |  |  |
| Classification: SVM |  |  |  |  |  |
| Classification: Multinomial Naïve Bayes |  |  |  |  |  |
| Classification: Random Forest |  |  |  |  |  |
| Classification: K-Nearest Neighbors |  |  |  |  |  |
|  |  |  |  |  |  |
| Hold-out validation set (if large sample) |  |  |  |  |  |
| K-fold CV (if small sample) |  |  |  |  |  |
| Gradient descent |  |  |  |  |  |
|  |  |  |  |  |  |
| Fully-connected NN |  |  |  |  |  |
| CNN |  |  |  |  |  |
| RNN (will not add marks) |  |  |  |  |  |
| Tune hyperparameters: batch size, number of layers, activation functions, neuron numbers, optimizers, learning rate, regularization, kernel size (CNN), # of filters (CNN), padding (CNN), pooling layer parameters (CNN), network architecture |  |  |  |  |  |
| Grid-search to tune |  |  |  |  |  |
|  |  |  |  |  |  |
| Text: sentiment analysis |  |  |  |  |  |
| Text: Latent Dirichlet Allocation |  |  |  |  |  |
| ***Evaluation metrics:*** |  |  |  |  |  |
| Underfitting or overfitting |  |  |  |  |  |
| MSE |  |  |  |  |  |
| RSS |  |  |  |  |  |
| accuracy |  |  |  |  |  |
| precision |  |  |  |  |  |
| recall |  |  |  |  |  |
| F1 |  |  |  |  |  |
| Confusion matrix (in heatmap) |  |  |  |  |  |
| ROC/AUC |  |  |  |  |  |
| Visualization of all models’ perform |  |  |  |  |  |
| ***Future improvements:*** |  |  |  |  |  |
|  |  |  |  |  |  |
| Mod13 concepts |  |  |  |  |  |
| ***Ethical discussions*** |  |  |  |  |  |
|  |  |  |  |  |  |