**Bull Market or Bear Market: Time Series Price Prediction for Q1 2024:**

**Modeling and Evaluation**

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**Modeling**

***Selecting Modeling Techniques***

* **The data types available for mining.** For example, are the fields of interest categorical (symbolic)?
* **Your data mining goals.** Do you simply want to gain insight into transactional data stores and unearth interesting purchase patterns? Or do you need to produce a score indicating, for example, propensity to default on a student loan?
* **Specific modeling requirements.** Does the model require a particular data size or type? Do you need a model with easily presentable results?

***Generating a Test Design***

As a final step before actually building the model, you should take a moment to consider again how the model's results will be tested. There are two parts to generating a comprehensive test design:

* Describing the criteria for "goodness" of a model
* Defining the data on which these criteria will be tested

A model's **goodness** can be measured in several ways. For supervised models, such as C5.0 and C&R Tree, measurements of goodness typically estimate the error rate of a particular model. For unsupervised models, such as Kohonen cluster nets, measurements may include criteria such as ease of interpretation, deployment, or required processing time.

Remember, model building is an iterative process. This means that you will typically test the results of several models before deciding on the ones to use and deploy.

***Building the Models***

At this point, you should be well prepared to build the models you've spent so long considering. Give yourself time and room to experiment with a number of different models before making final conclusions. Most data miners typically build several models and compare the results before deploying or integrating them.

In order to track your progress with a variety of models, be sure to keep notes on the settings and data used for each model. This will help you to discuss the results with others and retrace your steps if necessary. At the end of the model-building process, you'll have three pieces of information to use in data mining decisions:

* **Parameter settings** include the notes you take on parameters that produce the best results.
* The actual **models** produced.
* **Descriptions of model results**, including performance and data issues that occurred during the execution of the model and exploration of its results.

***Assessing the Model***

For each model under consideration, it is a good idea to make a methodical assessment based on the criteria generated in your test plan. Here is where you may add the generated model to the stream and use evaluation charts or analysis nodes to analyze the effectiveness of the results. You should also consider whether the results make logical sense or whether they are too simplistic for your business goals (for example, a sequence that reveals purchases such as wine > wine > wine).

Once you've made an assessment, rank the models in order based on both objective (model accuracy) and subjective (ease of use or interpretation of results) criteria.

Task List

* Using the data mining tools in IBM® SPSS® Modeler, such as evaluation charts, analysis nodes, or cross-validation charts, evaluate the results of your model.
* Conduct a review of the results based on your understanding of the business problem. Consult data analysts or other experts who may have insight into the relevance of particular results.
* Consider whether a model's results are easily deployable. Does your organization require that results be deployed over the Web or sent back to the data warehouse?
* Analyze the impact of results on your success criteria. Do they meet the goals established during the business understanding phase?
* ADDED. From Module 5 Canvas: In this draft, you should consider a forecast plot with a visual comparison and some discussion of data quality.

If you were able to address the above issues successfully and believe that the current models meet your goals, it's time to move on to a more thorough evaluation of the models and a final deployment. Otherwise, take what you've learned and rerun the models with adjusted parameter settings.

**Evaluation**

***Evaluating the Results***

At this stage, you formalize your assessment of whether or not the project results meet the business success criteria. This step requires a clear understanding of the stated business goals, so be sure to include key decision makers in the project assessment.

Task List

First, you need to document your assessment of whether the data mining results meet the business success criteria. Consider the following questions in your report:

* Are your results stated clearly and in a form that can be easily presented?
* Are there particularly novel or unique findings that should be highlighted?
* Can you rank the models and findings in order of their applicability to the business goals?
* In general, how well do these results answer your organization's business goals?
* What additional questions have your results raised? How might you phrase these questions in business terms?

After you have evaluated the results, compile a list of approved models for inclusion in the final report. This list should include models that satisfy both the data mining and business goals of your organization.

***Review Process***

Effective methodologies usually include time for reflection on the successes and weaknesses of the process just completed. Data mining is no different. Part of CRISP-DM is learning from your experience so that future data mining projects will be more effective.

Task List

First, you should summarize the activities and decisions for each phase, including data preparation steps, model building, etc. Then for each phase, consider the following questions and make suggestions for improvement:

* Did this stage contribute to the value of the final results?
* Are there ways to streamline or improve this particular stage or operation?
* What were the failures or mistakes of this phase? How can they be avoided next time?
* Were there dead ends, such as particular models that proved fruitless? Are there ways to predict such dead ends so that efforts can be directed more productively?
* Were there any surprises (both good and bad) during this phase? In hindsight, is there an obvious way to predict such occurrences?
* Are there alternative decisions or strategies that might have been used in a given phase? Note such alternatives for future data mining projects.

***Determining Next Steps***

By now, you've produced results, evaluated your data mining experiences, and may be wondering, **Where to next?** This phase helps you to answer that question in light of your business goals for data mining. Essentially, you have two choices at this point:

* **Continue to the deployment phase.** The next phase will help you to incorporate the model results into your business process and produce a final report. Even if your data mining efforts were unsuccessful, you should use the deployment phase of CRISP-DM to create a final report for distribution to the project sponsor.
* **Go back and refine or replace your models.** If you find that your results are almost, but not quite, optimal, consider another round of modeling. You can take what you've learned in this phase and use it to refine the models and produce better results.

Your decision at this point involves the accuracy and relevancy of the modeling results. If the results address your data mining and business goals, then you are ready for the deployment phase. Whatever decision you make, be sure to document the evaluation process thoroughly.

**References**

Industrial Business Machines Corporation (2021). *Introduction to CRISP-DM*. Industrial Business Machines Corporation. **https://www.ibm.com/docs/en/spss-modeler/saas**

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