

Deep Learning and AI (Apprentissage profond)

- Introduction aux réseaux de neurones profonds
- Application d'un réseau de neurones artificiels ANN sur le problème de désaxement des clients d'une entreprise (Churn problem)

Master 2 of Business Analytics

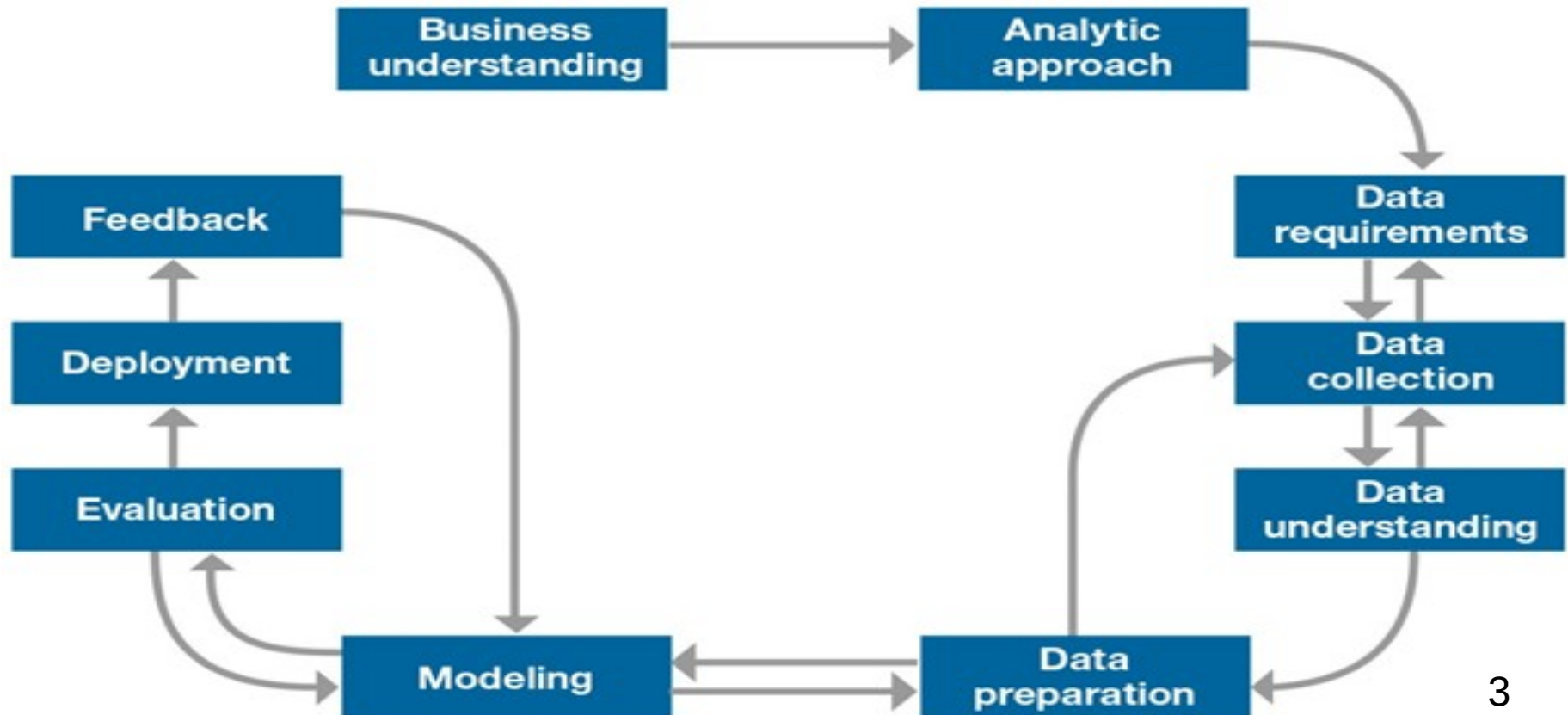
Ahmed Rebai Esprit School of Engineering

Aymen Ben Brik Esprit School of Business

Plan

- Problème de désaxement:
Côté entreprises vs côté Clients
- Modèles de prédiction de désaxement des clients
(accuracy vs. comprehensibility)
- Processus de la prédiction de désaxement
- Evaluation des modèles
- Conclusion

Methodology: IBM Master Plan



Business understanding: Churn problem

- Le **nombre des clients** et le **profit** sont deux variables corrélées ==> quand le nombre des clients augment alors le profit augmente aussi.



- Deux possibilités: Soit l'ajout des nouveaux clients soit la fidélisation des clients présents (Loyalty marketing is an approach to marketing, based on strategic management, in which a company focuses on growing and retaining existing customers through incentives)

Business understanding: Churn problem

- Recruit new customers:
- Saturated markets
- High costs
- Retain Existing customers
- Lower costs
- Loyalty benefits
- The longer you have a client with your company the less likely he is to leave the company.
- A satisfied/happy client: a word-of-mouth advertising (free advertising) family and friends

Example: the cell phone churn problem

- Cell phone customers often switch carriers. Called “churn”.
- Often cheaper to retain a customer than to acquire a new one.
- You can try to retain a customer by giving a promotion, such as a discount.
- If you give a discount to somebody who was going to churn, you probably saved money.

Churn perspective: Company

- Determinants of churn:
 - + What makes customers decide to churn?
 - + Make improvements in these areas
- May be physical or resource limitations

Churn perspective: Customer

- Correlation between churn and customer attributes (age, location where they live, how frequently they use the service, how many you generate from the customer use of the service, date to churn + past historical data)
- Build models based on past churn to predict future churn
- Target a retention campaign towards high risk customers (give 5 euros mobile card for example)

Example: the cell phone churn problem

- Suppose you have 2 years of customer data.
- For each customer, you know whether they “churned” (i.e changed service), and the date of churn if they did churn.
- How can we use machine learning and deep learning to find the most likely churners?

Churn Prediction Models

- Decision Trees
 - Logistic regression
 - Support Vector Machines
 - Bayesian networks
 - Survival analysis
 - Self-Organizing maps
 - Relational Classifiers
- or
- Deep Learning model : ANN

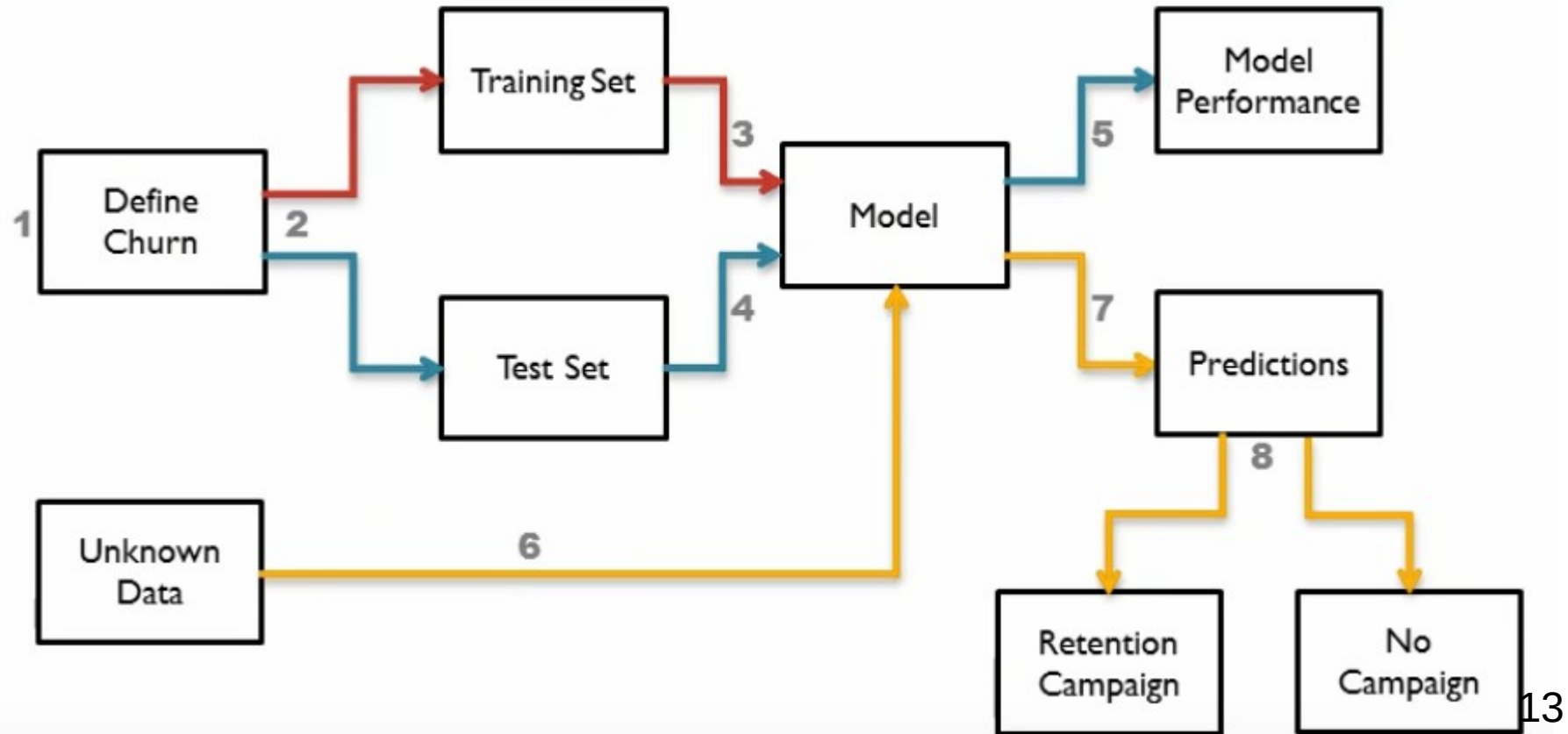
Model comprehensibility

- Accurate models allow precise targeting
- Comprehensibility allow:
 - + Domain expert assessment
 - + Insight into determinants of churn
 - + Easier adoption by business users

Popular Model Choices

- Logistic regression: Well-known and accepted, linear and simple, Interpretable, Comparatively good results
- Decision Trees: simple, interpretable, robust, care should be given to class skew
- Support Vector Machines and Neural Networks: Accurate but not easily interpreted
- Survival Analysis: Interpretable, time-to-churn
- Relational classifiers: Customer social network analysis

Churn Prediction Process

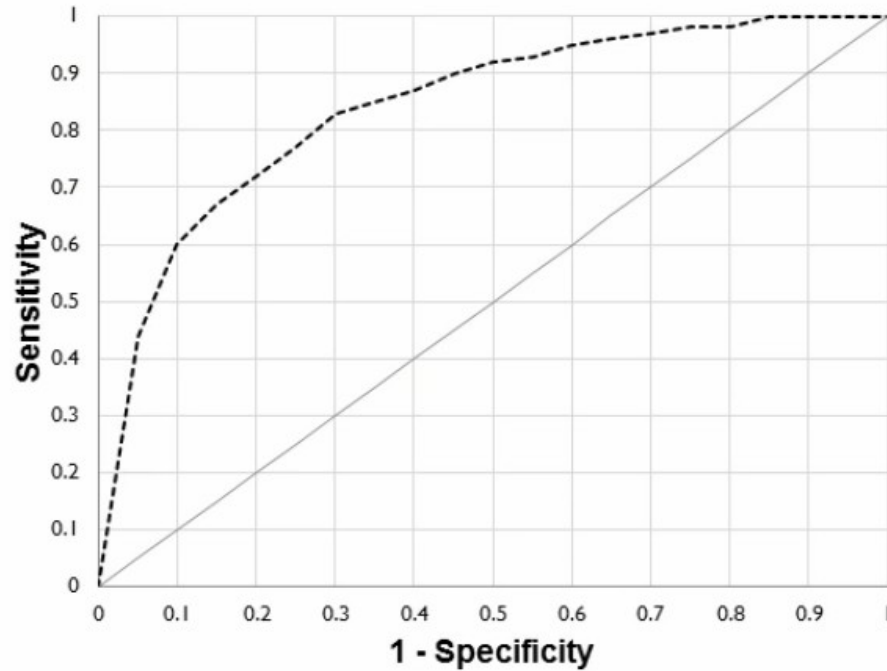


Model Evaluation

- Class skew: Far more non-churners than churners in a dataset
- Example:
 - +100 customers: 90 non-churn + 10 churn
 - + Model: All customers = non-churn
 - + Accuracy: 90%
- Increase accuracy in predicting churners:
 - + Over-sampling or Under-sampling
 - + Boosting
 - + Cost-sensitive methods (take into account the cost of miss-classified a non-churner vs the cost of a miss-classified a true-churner)

Evaluation Measures

- ROC-curve
- AUC

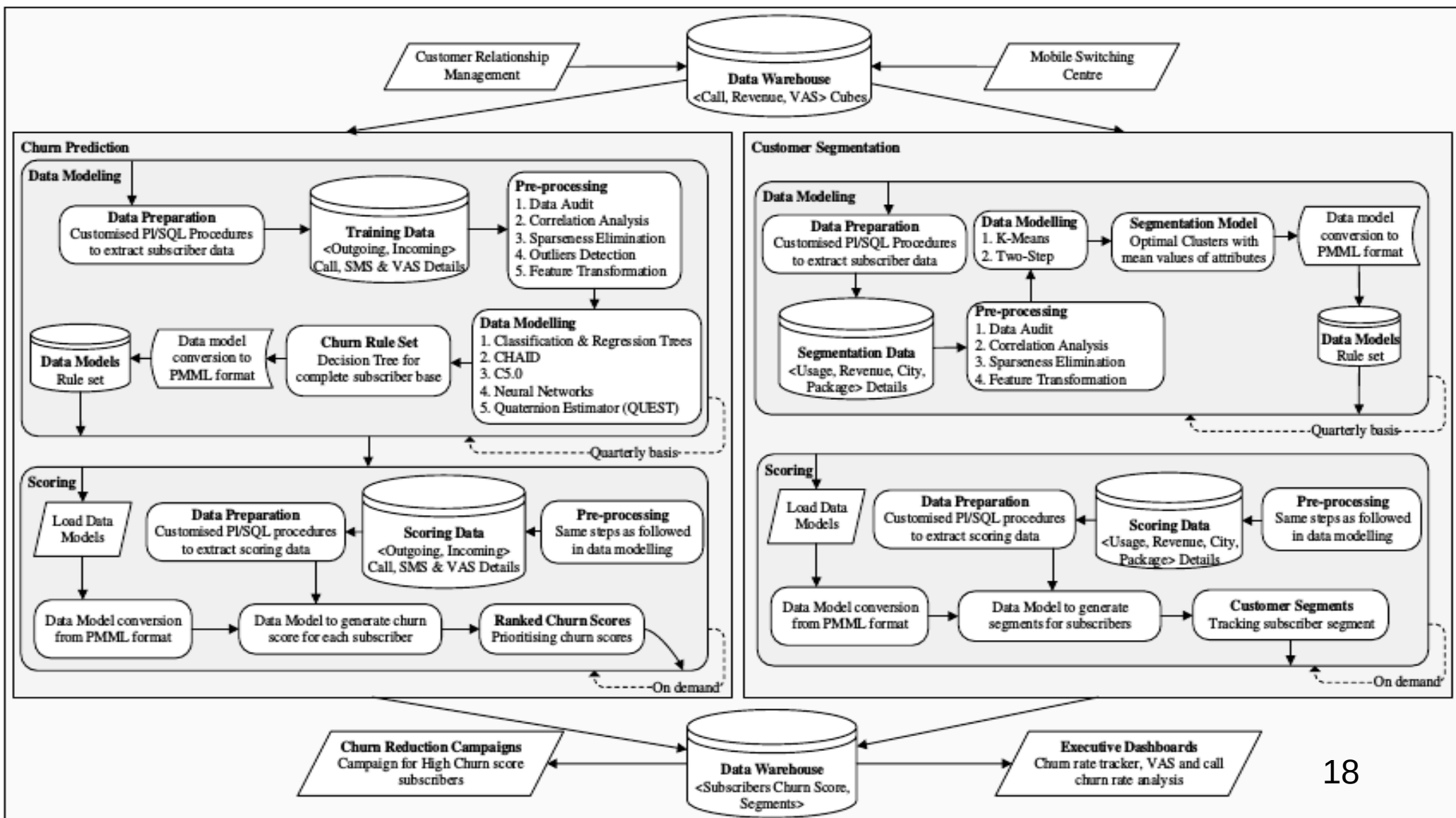


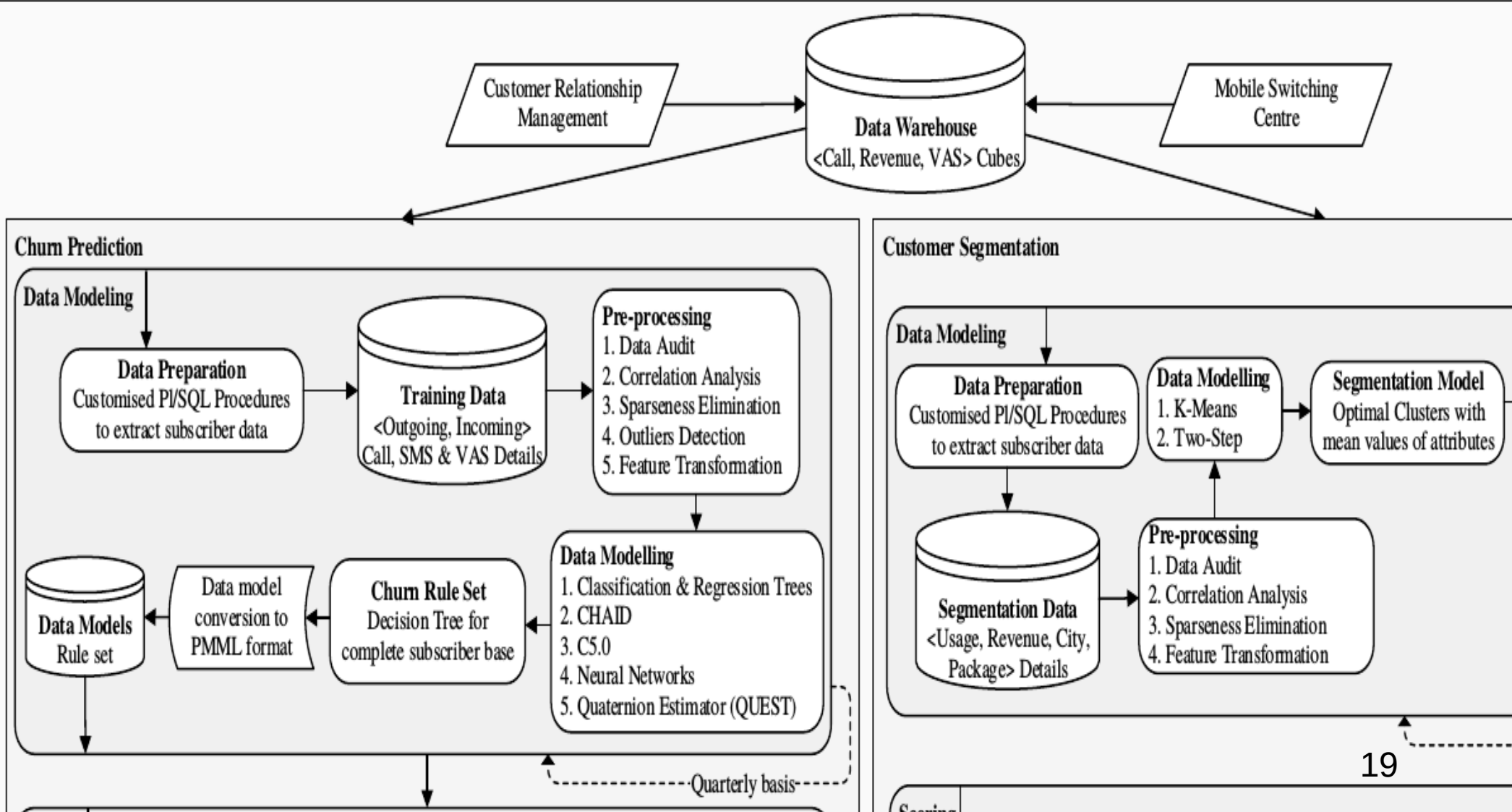
Evaluation Measures

- Lift Metric:
$$+ (5 \text{ churners} / 10 \text{ customers in top decile}) / (10 \text{ churners} / 100 \text{ churners in total}) = 50\% / 10\% = 5$$
- Expected Maximum Profit (EMP^{ccp}):
Using estimates for customer lifetime value, retention campaign costs, and distribution for acceptance rates, identify the optimal threshold and expected profit at that point.

Partial Conclusion

- To prevent churn:
 - + Company-based improvements
 - + Customer-based marketing
- In churn prediction:
 - + Be aware of class skew
 - + Consider both customer attributes and customer networks
 - + Interpretability, not just accuracy





Data Warehouse
<Call, Revenue, VAS> Cubes

Centre

Customer Segmentation

Data Modeling

Data Preparation

Customised PL/SQL Procedures
to extract subscriber data



Data Modelling

1. K-Means
2. Two-Step

Segmentation Model

Optimal Clusters with
mean values of attributes

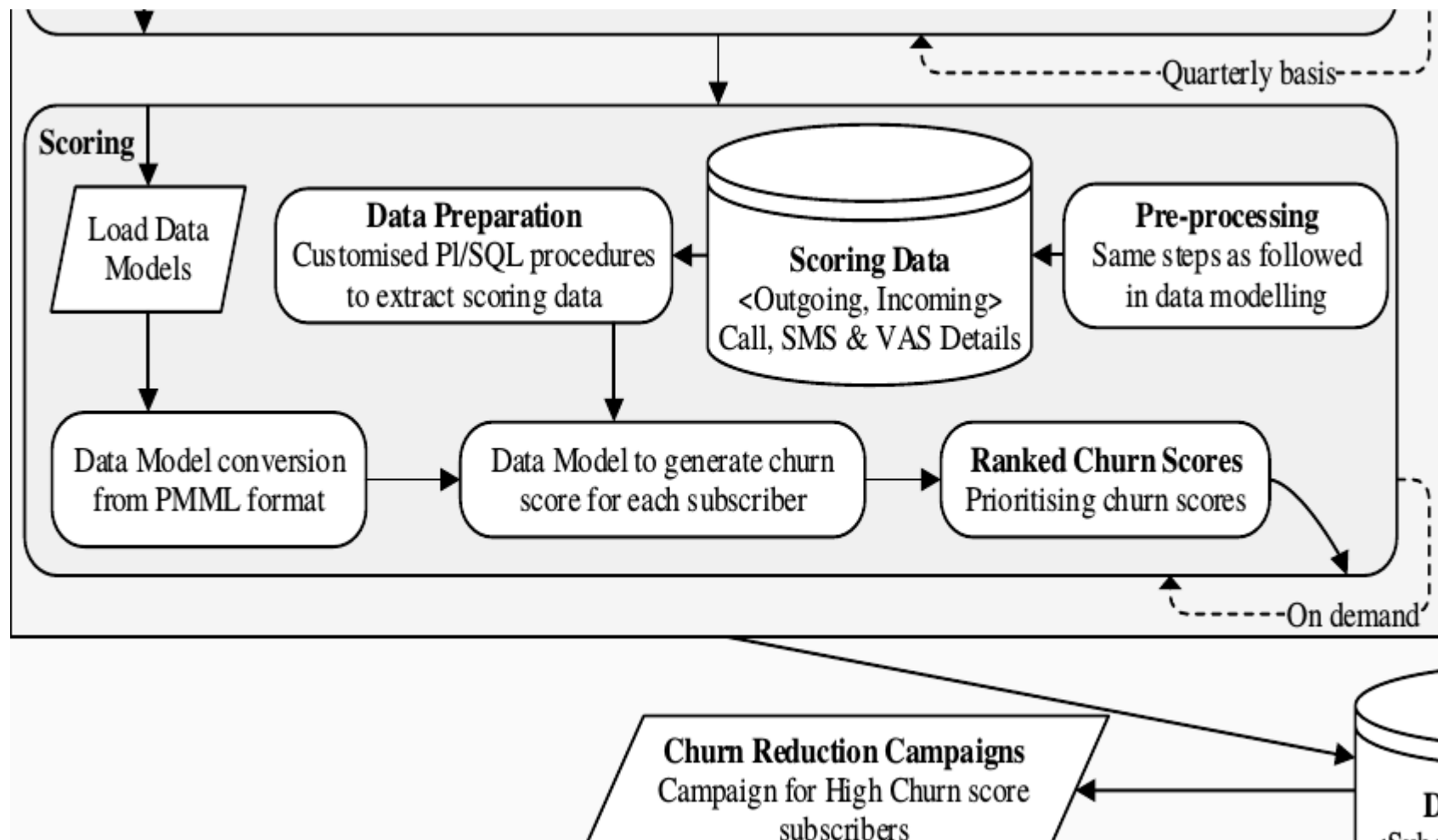
Data model
conversion to
PMML format

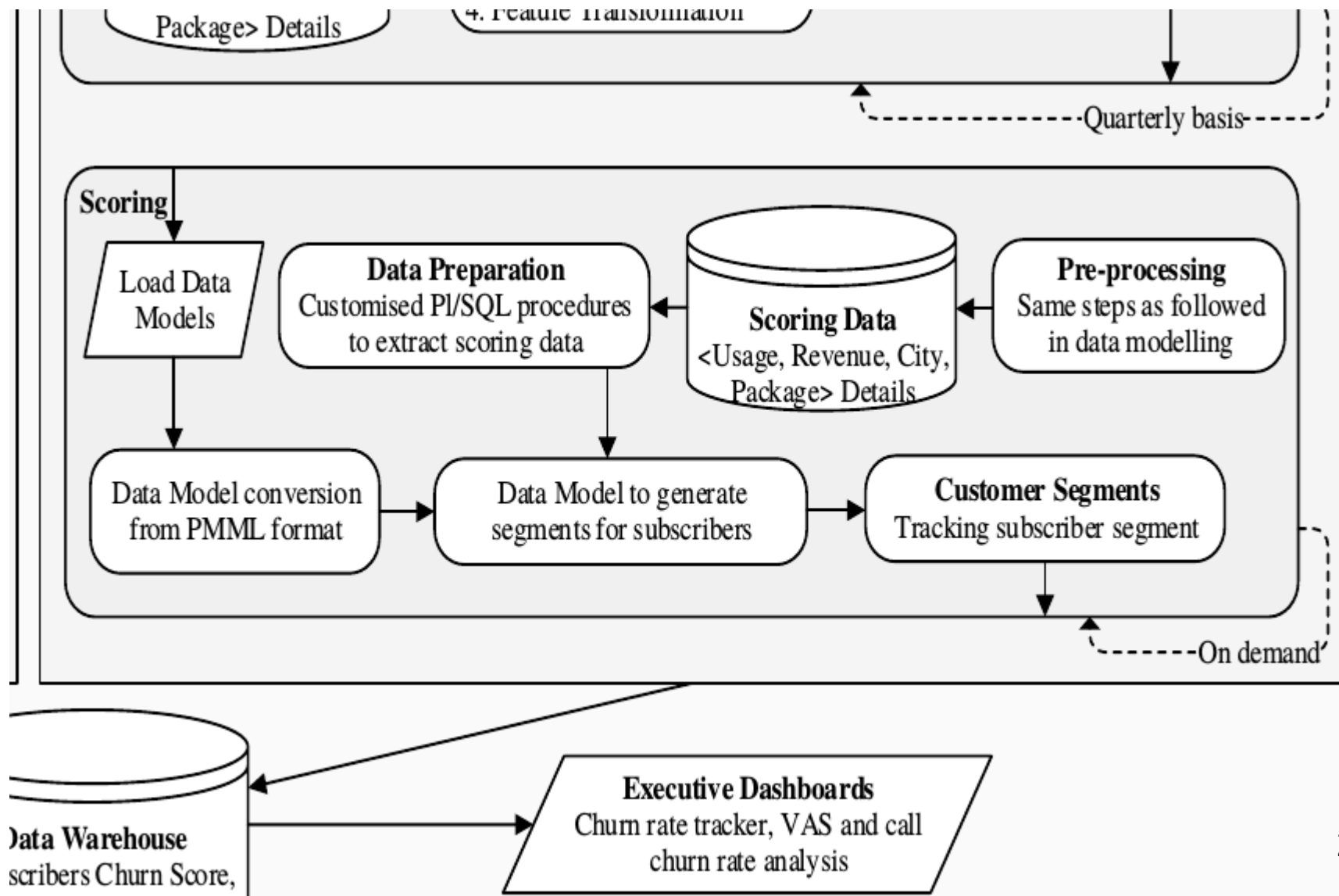
Pre-processing

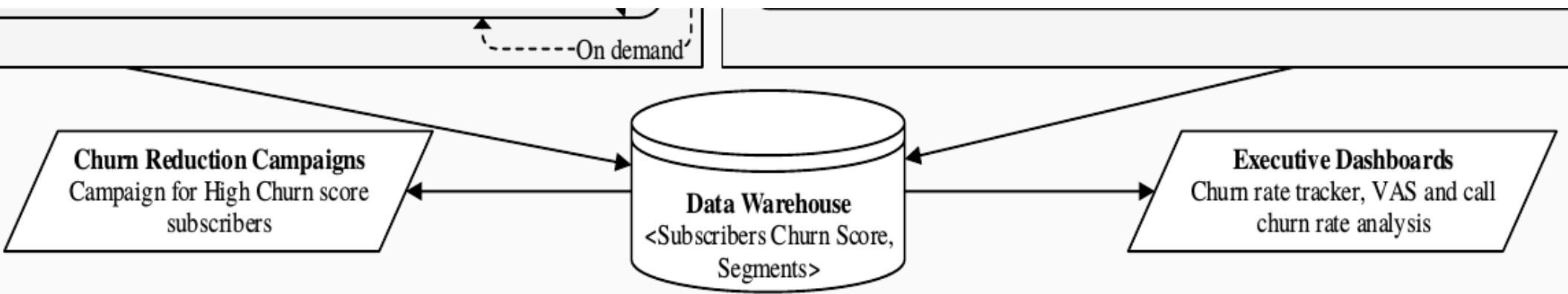
1. Data Audit
2. Correlation Analysis
3. Sparseness Elimination
4. Feature Transformation

Data Models
Rule set

Quarterly basis-20







re of churn prediction and customer segmentation models

