



Project „Flexible Assembly Processes for the Car of the Third Millennium (MyCar)“

Methodology Description (High Level)

Buyer Behaviour Modeling Tool



CASP

Methodology Description

a method of evaluating the probability that a customer, under a certain delivery time and price and given a set of factors, submits an order for a product

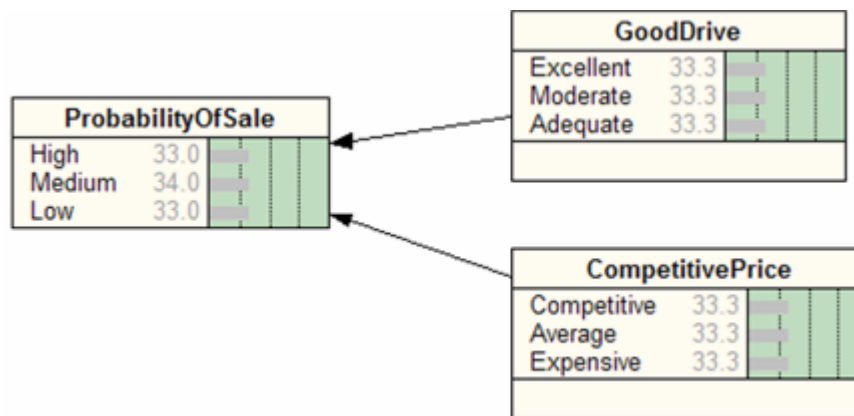
Basic math

- Law of total Probabilities
 - the probability of an incident A_1 is the sum of the probability of every incident B_n , multiplied with the probability of the incident A given the B_n
 - $P(A_1) = [P(A_1 | B_1) * P(B_1)] + [P(A_1 | B_2) * P(B_2)] + \dots + [P(A_1 | B_n) * P(B_n)]$
- Bayes' theorem
 - $P(A | B) = [P(B | A) * P(A)] / P(B)$

(Everitt 2006, Schay 2007).

Basic model

- Two factors identified to be having an impact on the probability of sale is the vehicle's driving quality and the Price competition.



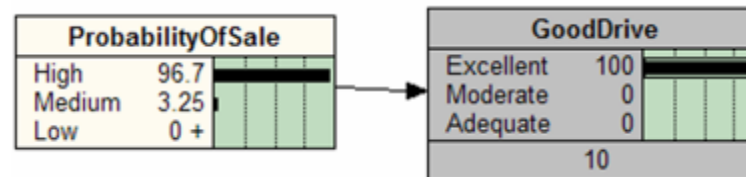
Bayesian model-2 factors

GoodDrive	CompetitivePrice	High	Medium	Low
Excellent	Competitive			
Excellent	Average			
Excellent	Expensive			
Moderate	Competitive			
Moderate	Average			
Moderate	Expensive			
Adequate	Competitive			
Adequate	Average			
Adequate	Expensive			

Conditional probabilities table
2 factors

Data entry reduction – Reverse model

- The model suggests using the *Bayes theorem*. For calculating the Probability of sale based on a set of factors
- For the case of the *GoodDrive* node, the likelihood that a state of the *ProbabilityofSale* node will occur will be calculated



(Makris, Chryssolouris, 2010).

Factors modeled

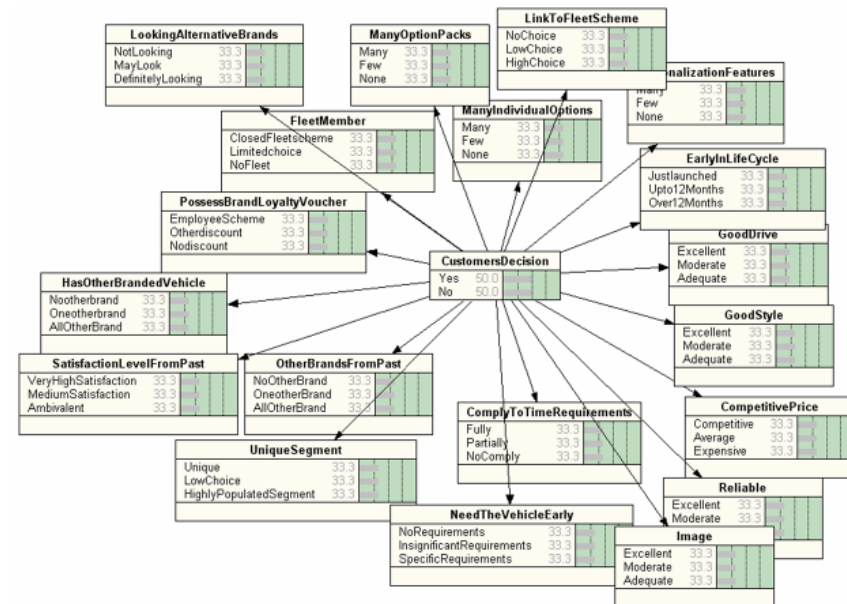
- 19 factors have been modeled
- Each factor has potential states.
- E.g. GoodDrive can be:
 - Excellent
 - Moderate
 - Adequate

Factor	Potential states		
FleetMember	<i>Closed Fleet scheme</i>	<i>Limited choice</i>	<i>No Fleet/open choice</i>
PossessBrandLoyaltyVoucher	<i>Employee Scheme</i>	<i>Other discount</i>	<i>No discount</i>
HasOtherBrandedVehicle	<i>No other brand</i>	<i>1 other brand</i>	<i>All Other Brands</i>
SatisfactionLevelFromPast	<i>Very high satisfaction</i>	<i>Medium satisfaction</i>	<i>Ambivalent</i>
OtherBrandsFromPast	<i>No other brand</i>	<i>1 other brand</i>	<i>All Other Brands</i>
UniqueSegment	<i>Unique</i>	<i>Low choice</i>	<i>Highly populated segment</i>
LookingAlternativeBrands	<i>Not looking</i>	<i>May look/not known</i>	<i>Definitely looking</i>
ManyOptionPacks	<i>Many</i>	<i>Few</i>	<i>None</i>
ManyIndividualOptions	<i>Many</i>	<i>Few</i>	<i>None</i>
PersonalizationFeatures	<i>Many</i>	<i>Few</i>	<i>None</i>
EarlyInLifecycle	<i>Just launched</i>	<i>Up to 12 months</i>	<i>Over 12 months</i>
NeedTheVehicleEarly	<i>No requirements</i>	<i>Insignificant requirements</i>	<i>Specific requirements</i>
ComplyToTimeRequirements	<i>Comply</i>	<i>Partially</i>	<i>Not Complying</i>
LinkToFleetScheme	<i>No choice</i>	<i>Low choice</i>	<i>High choice</i>
CompetitivePrice	<i>Competitive</i>	<i>Average</i>	<i>Expensive</i>
GoodDrive	<i>Excellent</i>	<i>Moderate</i>	<i>Adequate</i>
GoodStyle	<i>Excellent</i>	<i>Moderate</i>	<i>Adequate</i>
Reliable	<i>Excellent</i>	<i>Moderate</i>	<i>Adequate</i>
Image	<i>Excellent</i>	<i>Moderate</i>	<i>Adequate</i>

(Makris, Chryssolouris, 2010).

Bayesian network model

- All the 19 factors have been modeled in a Bayesian network.



(Makris, Chryssolouris, 2010).

Software tool snapshot

Dealer data entry form

Buyer behaviour inference model - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://127.0.0.1:8080/myCarSP46B.JSP/doInference

000 Automotive Engineering EU IT-R&D News Weather € Consumer UoP

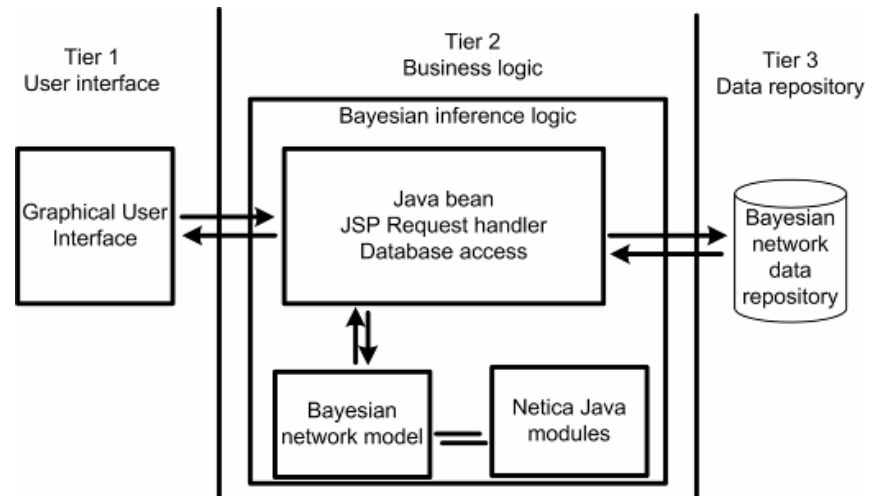
Inference model for buyer behaviour assesment

Select the factors values that apply for your customer

Is the buyer a member of a fleet scheme tied to our brand? Fleet scheme	<input type="radio"/> Closed	<input type="radio"/> Limited choice	<input type="radio"/> No Fleet/Open Choice
Is the buyer in possession of a Brand Loyalty discount voucher? Scheme	<input type="radio"/> Employee	<input type="radio"/> Other discount	<input type="radio"/> No discount
Does Buyer currently have another brand's vehicle? brand	<input type="radio"/> No other brand	<input type="radio"/> 1 other brand	<input type="radio"/> All other brand
Based on customer satisfaction survey- what is the level of satisfaction?	<input type="radio"/> Very high satisfaction	<input type="radio"/> Medium satisfaction	<input type="radio"/> Ambivalent
Over the last xx years, what brands has the customer owned? brand	<input type="radio"/> No other brand	<input type="radio"/> One other brand	<input type="radio"/> All other brand
			<input type="radio"/> Highly

Done Open Notebook Adblock

Web application architecture



Outcome of the tool

Outcome

According to this evaluation, the customer will most likely place his order, 56,7%, however, there is another 43,3% that he will not be placing his order.

The result of the evaluation is a relative measure and can be used for comparing alternative assessments that are performed for a customer.

Bayesian inference outcome

Is it known that the customer is looking at alternative vehicles/brands?	<input type="radio"/> Not looking	<input type="radio"/> May look/not known	<input checked="" type="radio"/> Definitely looking
How many Option packs has the customer requested	<input type="radio"/> Many	<input type="radio"/> Few	<input checked="" type="radio"/> None
How many Individual options has the customer requested	<input type="radio"/> Many	<input type="radio"/> Few	<input checked="" type="radio"/> None
What personalisation features has the customer requested (eg body/trim décor)	<input type="radio"/> Many	<input type="radio"/> Few	<input checked="" type="radio"/> None
At what point is the vehicle in the model 'life-cycle'?	<input type="radio"/> Just launched	<input checked="" type="radio"/> Up to 12 months	<input type="radio"/> Over 12 months
Has the customer expressed a specific time requirement for a defined purpose (eg vacation, without vehicle etc)?	<input type="radio"/> No requirements	<input checked="" type="radio"/> Insignificant requirements	<input type="radio"/> Specific requirements
Does the customer have a choice in the vehicle order (eg link to fleet scheme)?	<input checked="" type="radio"/> No choice	<input type="radio"/> Low choice	<input type="radio"/> High choice
Does the offered vehicle comply to customer's time requirements?	<input checked="" type="radio"/> Comply fully	<input type="radio"/> Comply partially	<input type="radio"/> Not complying
The car is competitively priced?	<input type="radio"/> Competitive	<input type="radio"/> Average	<input checked="" type="radio"/> Expensive
Drive quality?	<input type="radio"/> Excellent	<input type="radio"/> Moderate	<input checked="" type="radio"/> Adequate
Styling/looks?	<input type="radio"/> Excellent	<input type="radio"/> Moderate	<input checked="" type="radio"/> Adequate
Quality/reliability?	<input type="radio"/> Excellent	<input checked="" type="radio"/> Moderate	<input type="radio"/> Adequate
Image?	<input type="radio"/> Excellent	<input type="radio"/> Moderate	<input checked="" type="radio"/> Adequate

Submit New Customer Reset Customer's likely decision

Positive decision:	56,7%
Negative decision:	43,3%

References

- Everitt, B., S., 2006., The Cambridge dictionary of statistics, 3rd edition, Cambridge University Press.
- Schay, G., 2007. Introduction to probability with statistical applications, Birkhauser Boston.
- S. Makris, G. Chryssolouris, Customer's behavior modeling for manufacturing planning, International Journal of Computer Integrated Manufacturing, Volume 23, Issue 7 July 2010 , pages 619 – 629.