

An Analytics Solution For Retail Employee Turnover Workforce Management

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Overview

- Motivation
- Literature Review
- Data
- Methodology
- Models
- Results
- Conclusions

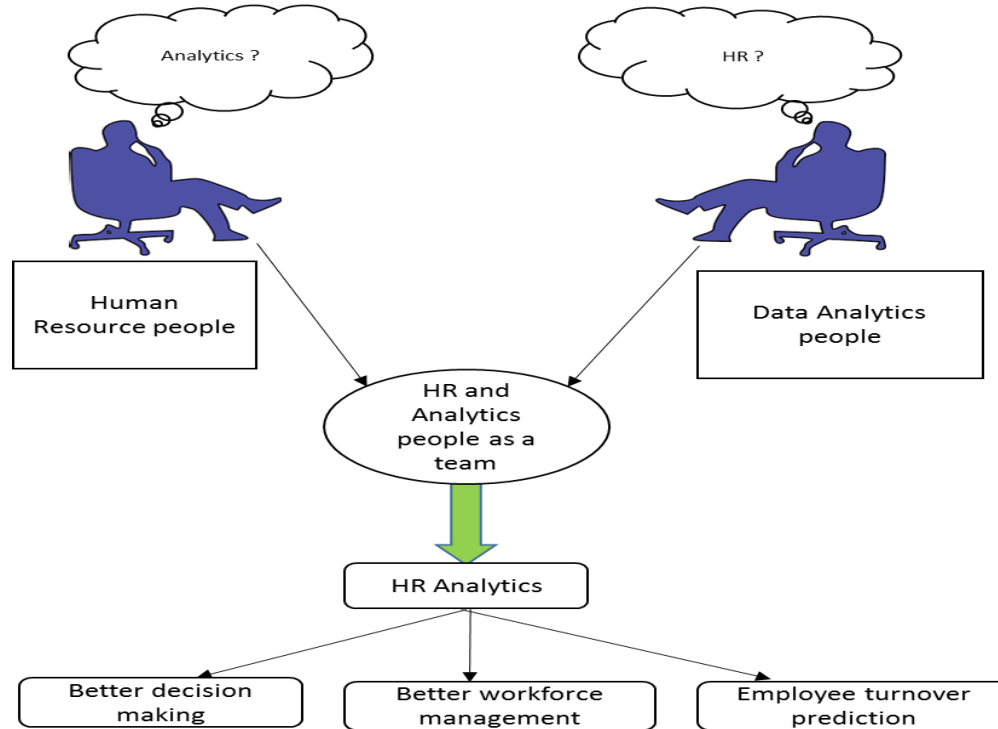
“Arguably the most practical tool and greatest potential for organizational management is the emergence of predictive analytics”

-FITZ-ENZ AND MATTOX II (2014)

Research question: How can predictive analytics be used to solve the problem of employee turnover and how can it change the current existing procedures?

Reasons why HR departments failing to leverage data analytics:

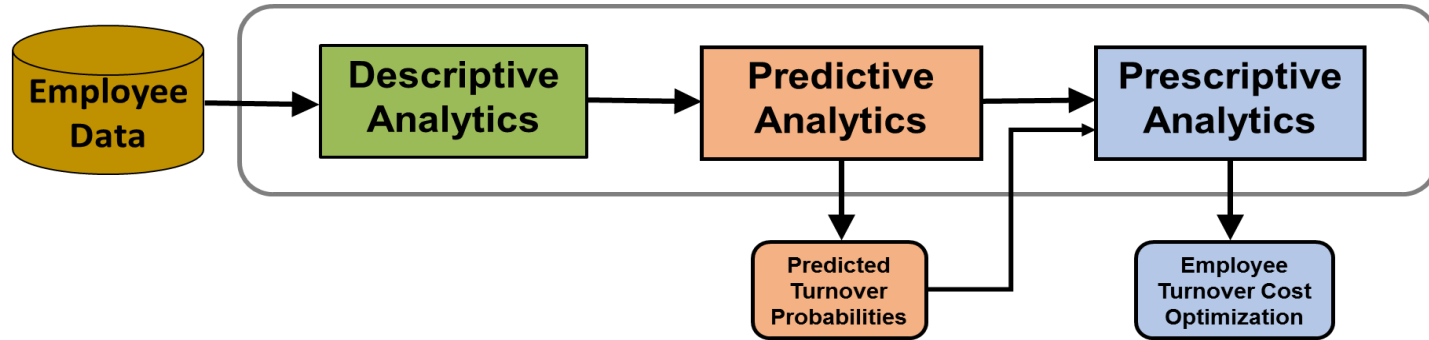
- Lack of data analytical skills in HR professionals
- Lack of awareness of how to use data analytics in HR practices
- Accuracy (or lack of) data collected during the surveys
- Data analysts not knowing the implementation issues of HR



- Studies of 1970s and 1980s states job satisfaction as the driver for the employee turnover
- Studies of 1980s and early 1990s states organizational environment, group cohesion, gender composition, and demography
- Later employee turnover studies were specific to some organizations and industries

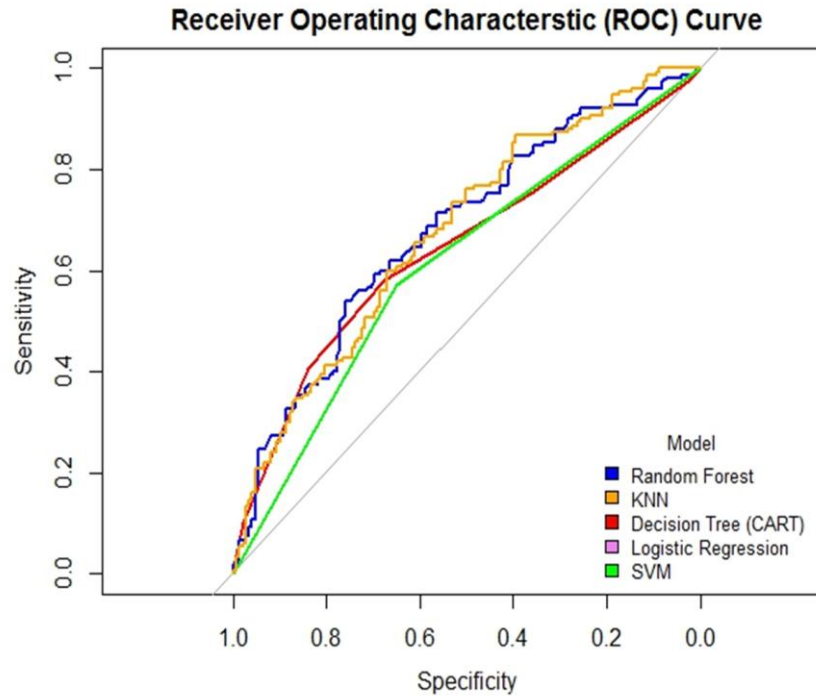
- Studies of early 2010s on the employee turnover were based on predictive modeling
- Several propose the idea of using data mining techniques in HR practices by demonstrating its prominence in leveraging decision making with their frameworks
- However, most do not provide any empirical investigation

- The data was provided from a regional retail company which is facing employee turnover problem
- Data contained: 1000 employees in which 500 employee are active and other 500 were terminated employees
- **Features include information about:** store demographics, position titles, type of pay, pay amount, market index of pay per position, employee performance reviews over the previous two years, and store performance over the previous two year.



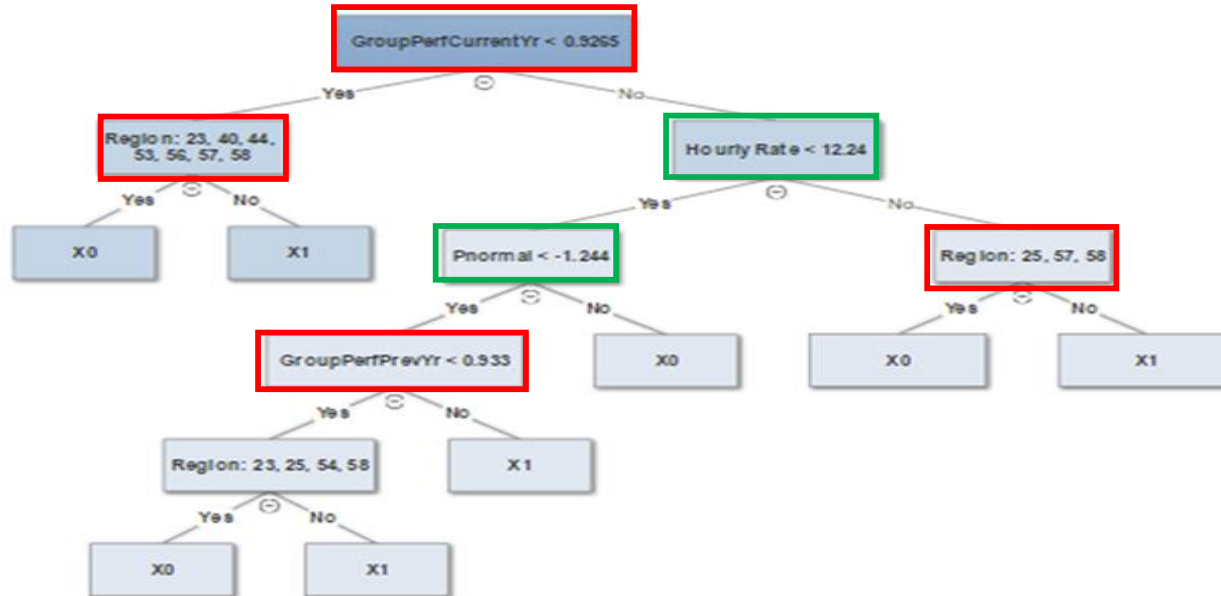
- **Data partition:** 70% as Train data and 30% as Test data
- Predictive models were built on Train data and were evaluated on Test data
- Five predictive models were totally tried on the data set
- Decision model for HR's is made using best predictive model

- Logistic Regression
- CART
- Random Forests
- Support Vector Machines
- K-Nearest Neighbors



- Best model based on AUC was the KNN
- However, HR professionals found this method confusing

- We preferred CART model as it (1) gave good performance and (2) it is easy for HR to understand



Prescriptive Analysis

Decision variables

x_{ij} = amount to increase wage of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$

y_{ij} = decision to fire employee i in store j , $y_{ij} \in \{0,1\}$; $i = 1, \dots, N$; $j = 1, \dots, M$

Parameters:

N = total number store employees

B_{ij} = wage of store manager position i in store j ; $i = 1, \dots, B$; $j = 1, \dots, M$

S_{ij} = wage of sales associate position i in store j ; $i = 1, \dots, S$; $j = 1, \dots, M$

T_{ij} = wage of stockers position i in store j ; $i = 1, \dots, T$; $j = 1, \dots, M$

τ_{ij} = latest performance review of employee type i in store j ; $i = 1,2,3$; $j = 1, \dots, M$

ϕ_{ij} = hourly rate (\$) of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$

ω_{ij} = wage index of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$

ρ_{ij} = estimated probability of turn in next 6 months of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$

Ψ_{ij} = estimated class of turn in next 6 months of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$; $\Psi_{ij} \in \{0,1\}$

K_{ij} = the average team performance of employee type i in store location j ; $j = 1, \dots, M$ (specified by HR)

Z_j = the average team performance of stockers at store location j ; $j = 1, \dots, M$

A = the next sixth month budget (\$) for store managers

B = the next sixth month budget (\$) for sales associates

Γ = the next sixth month budget (\$) for stockers

Based on how the decision variables change, these parameters will change

φ_{ij}^* = new hourly rate (\$) of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$

ω_{ij}^* = new wage index of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$

ρ_{ij}^* = new estimated probability of turn in next 6 months of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$

ψ_{ij}^* = new estimated class of turn in next 6 months of employee i in store j ; $i = 1, \dots, N$; $j = 1, \dots, M$; $\psi_{ij} \in \{0,1\}$

Objective function:

$\max[\sum_j \sum_i \psi_{ij}^*] / N$ (maximize the percentage of expected non-turners to complete workload)

Constraints:

$\sum_i \tau_{ij} / S \geq K_{ij} \quad \forall j$ (average employee type performance should exceed some threshold)

$1040 * \sum_j \sum_i B_{ij} \leq A$ (budget for store managers must be satisfied)

$1040 * \sum_j \sum_i S_{ij} \leq B$ (budget for sales associates must be satisfied)

$1040 * \sum_j \sum_i T_{ij} \leq \Gamma$ (budget for stockers must be satisfied)

$\sum_j \sum_i \omega_{ij}^* / N \geq 0.95$ (average wage index of employee type i is at least 0.95; 1 would imply market avg.)

$x_{ij} \geq 0$ (hourly wages will can only increase)

$y_{ij} \in \{0,1\}$

- We are still working on our decision model, our goal is to come up with a framework which can be used by manufacturing companies
- Our decision model can be improved by taking the expertise of HR practitioners of manufacturing companies
- For manufacturing companies we might have to add/delete a decision variables.

Questions?