CHARLES Change-Aware Recovery of Latent Evolution Semantics in Relational Data

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How did my data change? Why?

name	gen	edu	exp	salary	bonus
Anne	F	PhD	2	$230,000	$23,000
Bob	M	PhD	3	$250,000	$25,000
Amber	F	MS	5	$160,000	$16,000
Allen	M	MS	1	$130,000	$13,000
Cathy	F	BS	2	$110,000	$11,000
Tom	M	MS	4	$150,000	$15,000
James	M	BS	3	$120,000	$12,000
Lucy	F	MS	4	$150,000	$15,000
Frank	M	PhD	1	$210,000	$21,000

2016 data

name	gen	edu	exp	salary	bonus
Anne	F	PhD	3	$230,000	$25,150
Bob	M	PhD	4	$250,000	$27,250
Amber	F	MS	6	$160,000	$17,440
Allen	M	MS	2	$130,000	$13,790
Cathy	F	BS	3	$110,000	$11,000
Tom	M	MS	5	$150,000	$16,400
James	M	BS	4	$120,000	$12,000
Lucy	F	MS	5	$150,000	$16,400
Frank	M	PhD	2	$210,000	$23,050

2017 data

Why is the **bonus** different in 2017? What happened?

I wonder why some people received a bonus increase, such as Anne got a $2150 increase, while others like Cathy didn't get any!

ChARLES explains changes in data

- Provides **semantic explanations**
- Each explanation consists of a series of **conditional transformations.**

Conditional Transformation

Condition → *Transformation*

Source dataset

Target dataset

Parameter Tuning

Diff Discovery Engine

Linear Model Tree (LMT)

Fit a linear regression line in each leaf

Ensemble

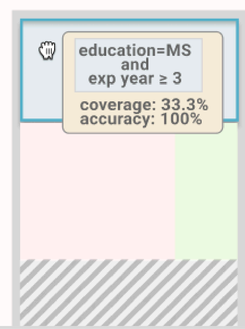
Multiple LMTs

Explanations

Ranker

Show the top 10 explanations

	Explanation		Details	Score	Accuracy	Interpretability
1	education=PhD	bonus_new = 1.05 X bonus_old + 1000	Interactive Visualization	89%	100%	78%
	education=MS and exp year ≥ 3	bonus_new = 1.04 X bonus_old + 800				
	education=MS and exp year < 3	bonus_new = 1.03 X bonus_old + 400				
2	education=PhD	bonus_new = 0.1 X salary + 0.01 X bonus_old + 1000		81%	97%	65%
	gender=F and education=MS	bonus_new = 0.1 X salary + 0.01 X bonus_old + 800				
	gender=M and education=MS	bonus_new = 0.13 X salary + 0.01 X bonus_old - 3175				



ChARLES balances accuracy and interpretability

Everyone receives about 6% increase

Less Accurate

More Interpretable

If PhD → *5% increase + $1000*

If MS and served at least 3 years → *4% increase + $800*

If MS and served less than 3 years → *3% increase + $400*

Reasonably Accurate

Reasonably Interpretable

If PhD and Female → *5% increase + $1000*

If MS and Female and served at least 3 years → *4% increase + $800*

If MS and Male and served at least 3 years → *4% increase + $700*

If BS and Female and served less than 3 years → *3% increase + $400*

If BS and Male and served less than 3 years → *3% increase + $300*

More Accurate

Less Interpretable

Looks like the company opted for a policy to reward **long-serving** employees and promote **educational advancement**.