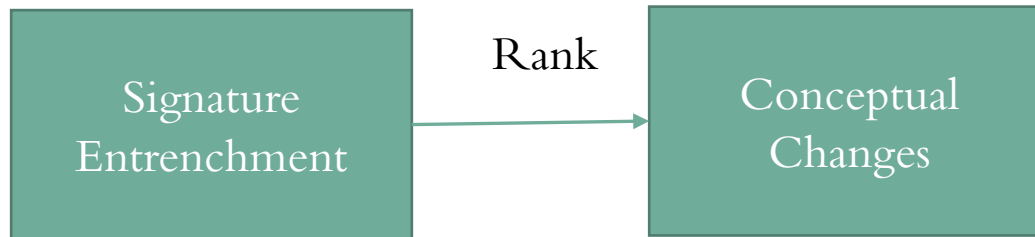# SIGNATURE ENTRENCHMENT AND CONCEPTUAL CHANGES IN AUTOMATED THEORY REPAIR

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SIGNATURE ENTRENCHMENT

- Signature Entrenchment: measures the informational value of a signature element used to express conceptual knowledge, i.e., predicates and the arguments.

Signature Entrenchment	Rank →	Conceptual Changes

Data1:   mum(lily, victor, birth)

Data2:   mum(lily, victor)

Data3:   mumBirth(lily, victor)

Input: 1. Benchmark including positive examples and negative examples.
            2. A Datalog theory.
Output: Ranked repaired theories.

Fully Trusted

ARGUMENT ENTRENCHMENT

- Argument entrenchment is a measure of the contribution of arguments for a predicate. It is defined based on the ***diversity:*** the number of the individuals occurring as the argument.

mum(lily, victor, birth)

anna	tom	step
lucy	lily	god
mei	jake	
cat	david	
...	lei	
	...	

mum(? , victor, birth)   mum(lily , ? , birth)   mum(lily , victor , ?)
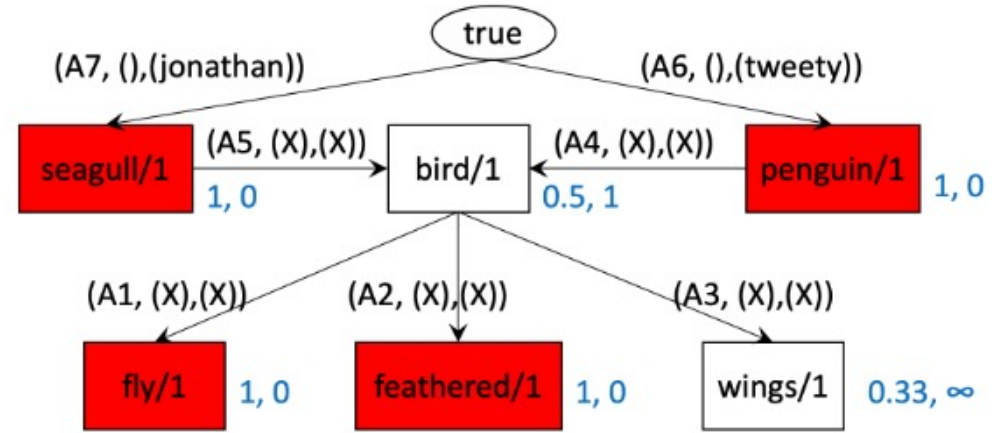
It is ranked lowest, as desired.

PREDICATE ENTRENCHMENT

Example 4.1. *Bird Theory* $\mathbb{T}_b$.

$$bird(X) \implies fly(X) \qquad (A1)$$
$$bird(X) \implies feathered(X) \qquad (A2)$$
$$bird(X) \implies wings(X) \qquad (A3)$$
$$penguin(X) \implies bird(X) \qquad (A4)$$
$$seagull(X) \implies bird(X) \qquad (A5)$$
$$\implies penguin(tweety) \qquad (A6)$$
$$\implies seagull(jonathan) \qquad (A7)$$

Fault: Penguin Tweety cannot fly!

Theory graph of Example 4.1: entrenchment of each predicate X followed by corresponding confidence distance Y, given in the form of X,Y.

A Preferred Repair ($\mathbb{T}_{rp}$) for the Faulty Bird Theory in Example 4.1.

$$birdFlying(X) \implies fly(X) \qquad (A1)$$
$$bird(X) \implies feathered(X) \qquad (A2)$$
$$bird(X) \implies wings(X) \qquad (A3)$$
$$penguin(X) \implies bird(X) \qquad (A4)$$
$$seagull(X) \implies bird(X) \qquad (A5)$$
$$seagull(X) \implies birdFlying(X) \qquad (A5')$$
$$\implies penguin(tweety) \qquad (A6)$$
$$\implies seagull(jonathan) \qquad (A7)$$

A Dispreferred Repaired Bird Theory $\mathbb{T}_{brb}$.

$$bird(X) \implies flyAbnormal(X) \qquad (A1)$$
$$bird(X) \implies feathered(X) \qquad (A2)$$
$$bird(X) \implies wings(X) \qquad (A3)$$
$$penguin(X) \implies bird(X) \qquad (A4)$$
$$seagull(X) \implies bird(X) \qquad (A5)$$
$$seagull(X) \implies fly(X) \qquad$$
$$\implies penguin(tweety) \qquad (A6)$$
$$\implies seagull(jonathan) \qquad (A7)$$

Ranked low based on PE

CONCLUSION

- Signature entrenchment measured with scores for: predicates and arguments.

- Application: ranking repairs based on the smallest reduction in entrenchment scores.

- Limitations:
    1. It is unclear how to compare entrenchment across predicates and constants.
    2. More experiments are needed, especially to compare the measurement with human judgement.