MOFAE: Multi-objective Optimization Approach to Framework API Evolution

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Problem
Framework API changes may break the client programs after upgrading
Very few frameworks provide adaptation rules
The adaptation process is time consuming

Existing Approaches
Existing approaches use different features:
- Call-dependency
  SemDiff, Schäfer et al., Beagle, HiMa, AURA, Halo
- Text-similarity
  Kim et al., Beagle, AURA, Halo
- Software design model
  Diff-CatchUp
- Software metrics
  Beagle
- Comments
  HiMa, Halo

Limitations
Single-feature approaches:
- Call-dependency
- Text-similarity
- Software metrics
- Comments
Hybrid approaches: which feature to trust?

MOFAE
1. Recommendation system modeling framework API evolution as a MOOP problem
2. Use four features: call-dependency similarity, method signature text similarity, inheritance tree similarity, and method comment similarity
3. Select the candidates that no other candidates are better than in all the features
4. Sort the selected candidates by in how many features they are the best

Objectives
- Call dependency similarity
- Confidence value and support
- Comment similarity
- Longest Common Subsequence (LCS)
- Method signature text similarity
- LCS, Levenshtein Distance (LD), and Method-level Distance (MD)
- Inheritance similarity
- Inheritance tree string LCS

Results
- MOFAE can detect 18% more correct change rules than previous works.
- Average size 3.7, median size 2.2, maximum size 8.
- 87% correct recommendations are the first, 99% correct recommendations are in top three.
- Effort saving 31%

Evaluation
Output
- Target: DefaultBtn$ButtonsDataset.java MaxOrderValue(),
- Objective: Inheritance Tree String LCS, Method Signature LD
- MOFAE

Effect Analysis
- $S_{max}$, a maximum number of tries.
- #C, Number of correct recommendations
- |T|, total missing API number
- Single-recommendation approaches:
  - $E_{DA} = \frac{#C_{DA} \times EE}{|T| \times (|T| - #C_{DA}) \times EE}$$
  - Multi-recommendation approaches:
    - $E_{DA} = \frac{S_{DA} \times S_{new}}{S_{DA} \times S_{new} - S_{max}}$

Limitations
Semi-automatic
Depends on the features

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