DFRWS

OBA2: An Onion approach to Binary code Authorship Attribution

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Outline

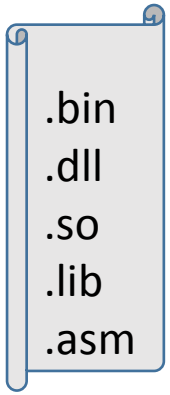
- Introduction
- Challenges
- Related Work
- Proposed Solution (OBA2)
- Implementation
- Results
- Conclusion

Introduction

- What is OBA2?
  - Multilayer approach to binary authorship attribution
- Why do we need OBA2?
  - Authorship Attribution
  - Reverse Engineering
- How does OBA2 work?
  - Code Filtration
  - Syntax-based attribution
  - Semantic-based attribution

Introduction

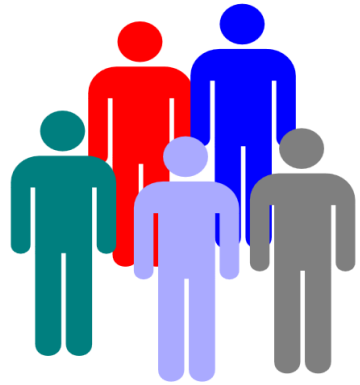
"On the Internet, nobody knows you're a dog."



Abstraction

Stylometric Features

Mapping



Challenges

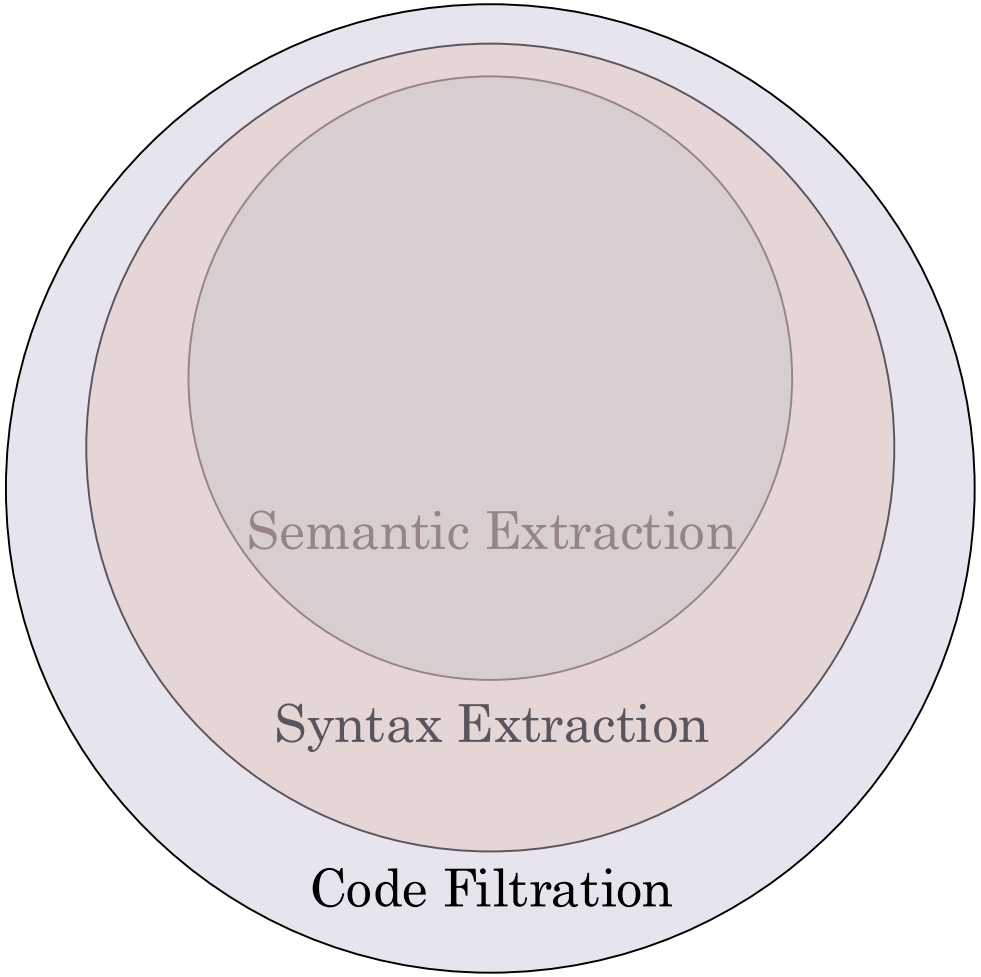
- Tool validation
  - Candidate methods (statistics analysis) – same results
  - Style vs. functionality
- "Good" validation dataset
  - Code reuse
  - Several authors per file
- Heterogeneous dev. environments

Related Work

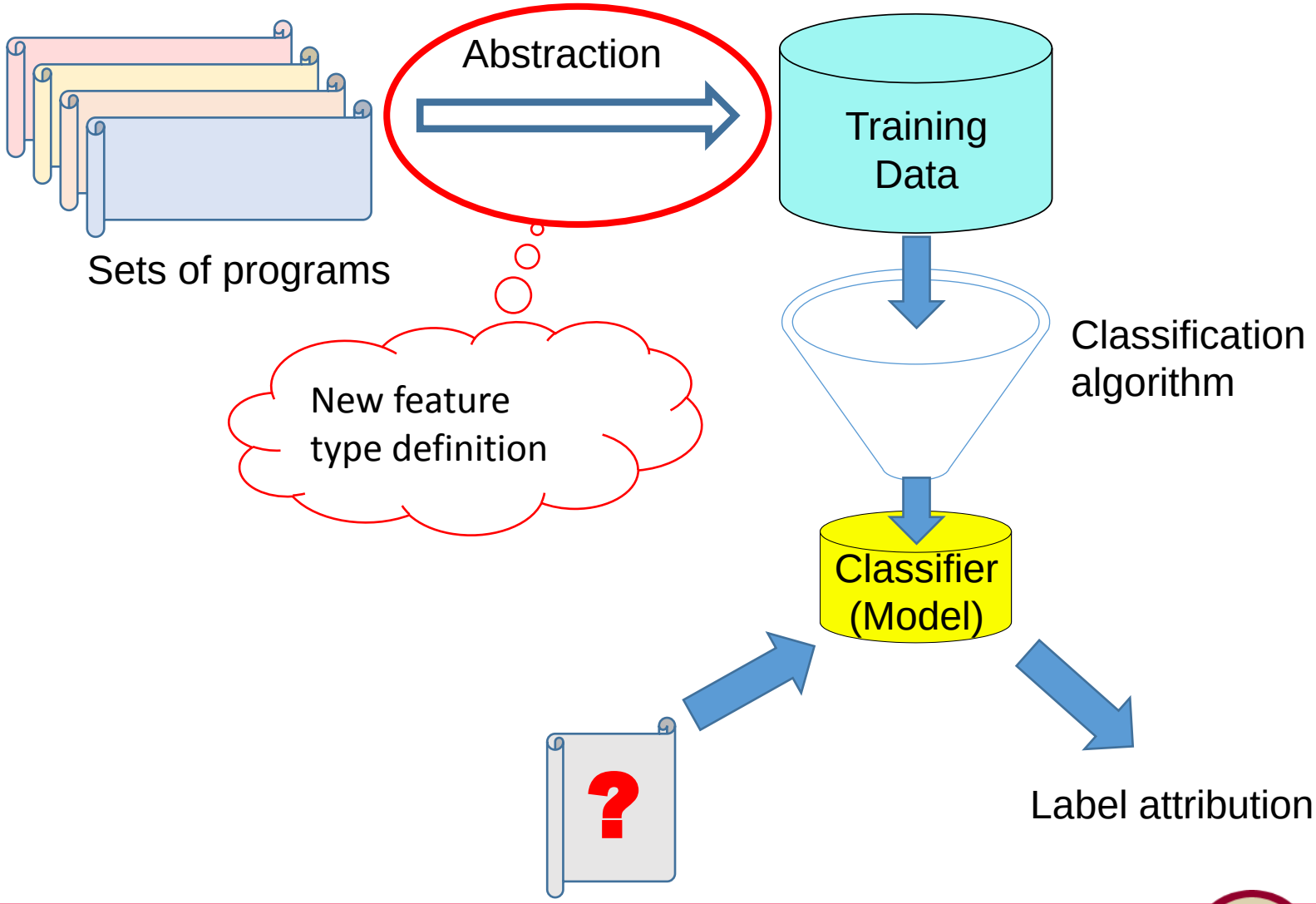
- Rosenblum et al extracts features using five pre-defined templates
  - Idioms
    - ✓ short sequences of instructions
  - Graphlets
    - ✓ 3-node subgraph of the Control Flow Graph (CFG)
  - Supergraphlets
    - ✓ collapsing and merging neighbor nodes of the CFG
  - Libcalls and Call Graphlets
    - ✓ function names of imported libraries
  - N-grams:

Proposed Solution (OBA2)

- Why do we choose onion?

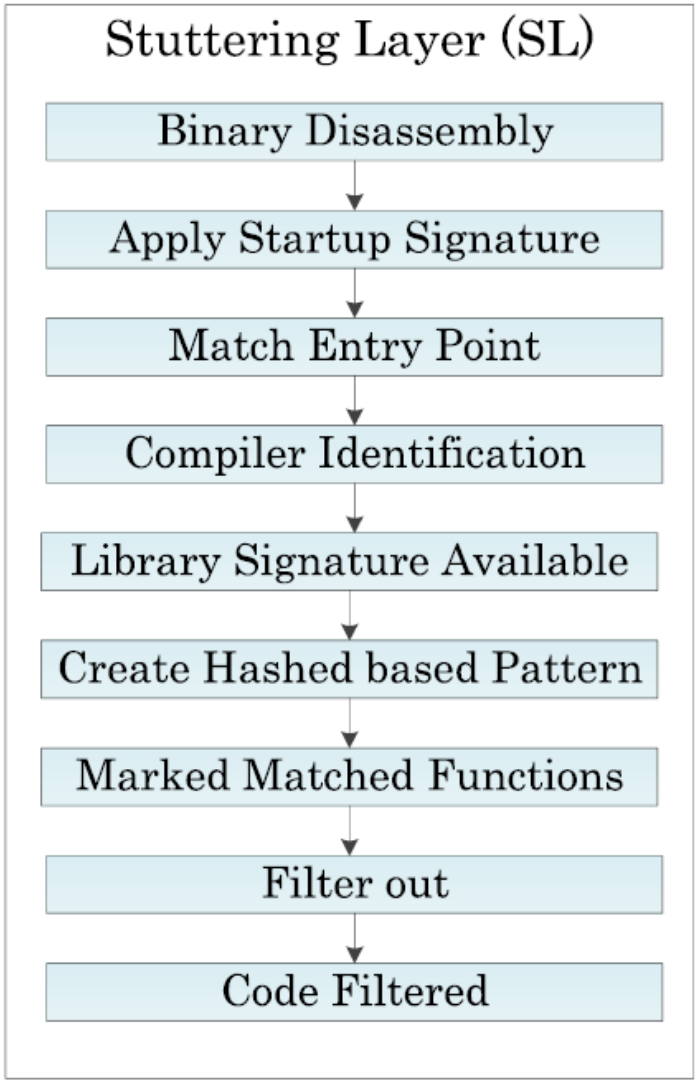


Proposed Solution (OBA2)



Proposed Solution (OBA2)

- Stuttering Layer



Proposed Solution (OBA2)

- Code Analysis Layer

STL				
Category	Class	Exact	Inexact	No
Container	Pair	x		2
	Vector			
	List		x	1
	Queue			
	Stack	x		1
	Hash sets			
	Valarray		x	2
Algorithm	Sort			
	Depth-first search		x	1
	Dijkstra's algorithm			
	Minimum spanning			
	Breadth-first search		x	1
Socket	Data transfer mech			
	Options management		x	2
	Network addressing	x		3
	Connection setup	x		3
I/O	stdin	x		3
	printf	x		4
	scanf	x		2
	puts	x		1
	gets			
	getche		x	1
Encryption	TEA			
	RC4		x	2
	AES			
	MD5			
	RSA			

Proposed Solution (OBA2)

- Register Flow Analysis Layer

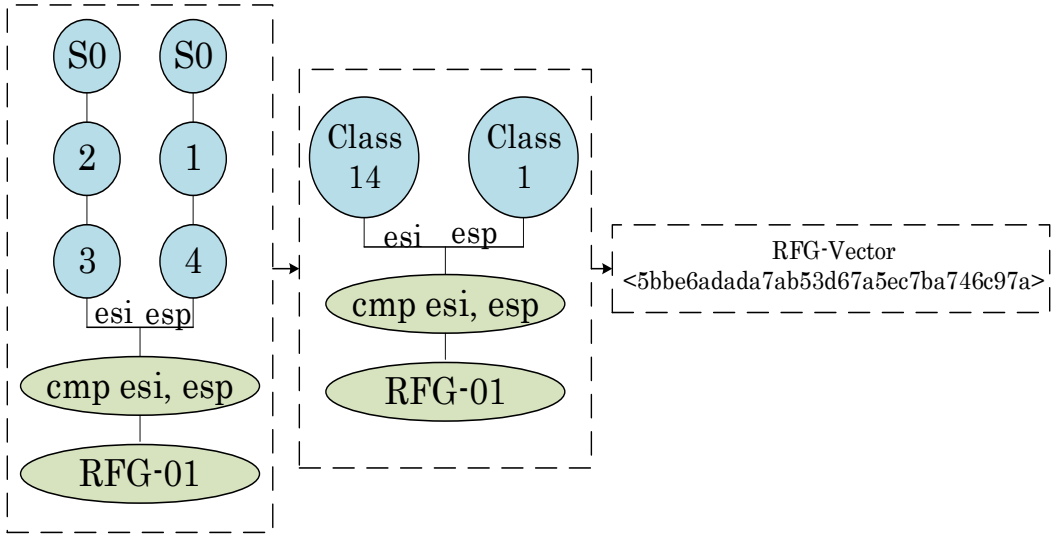
Class	Arithmetic	Logical	Generic	Stack
1	1	0	0	0
2	0	1	0	0
3	0	0	1	0
4	0	0	0	1
5	1	1	0	0
6	1	0	1	0
7	1	0	0	1
8	1	1	1	0
9	1	1	0	1
10	1	0	1	0
11	1	1	1	1
12	0	1	1	0
13	0	1	0	1
14	0	0	1	1
15	0	1	1	1

Proposed Solution (OBA2)

- Register Flow Graph
  - “CMP op1, op2”
  - RFG root encodes the operands combination
  - RFG leaves encode instruction classes
  - < root, color, dissim. >
- ASM instruction and register classes

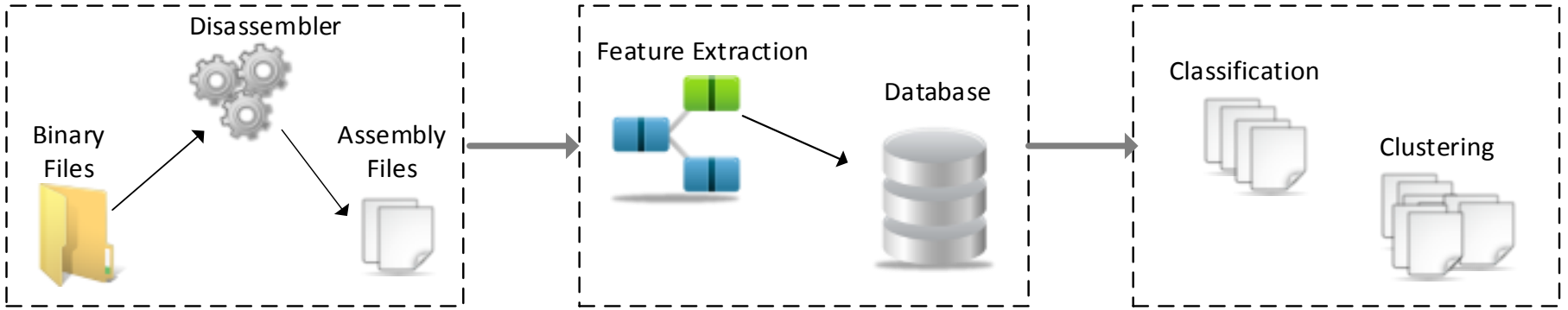
Proposed Solution (OBA2)

```
1.   sub      esp, 0D8h
2.   push     esi
3.   mov      esi, esp
4.   add      esp, 8
5.   cmp      esi, esp
```



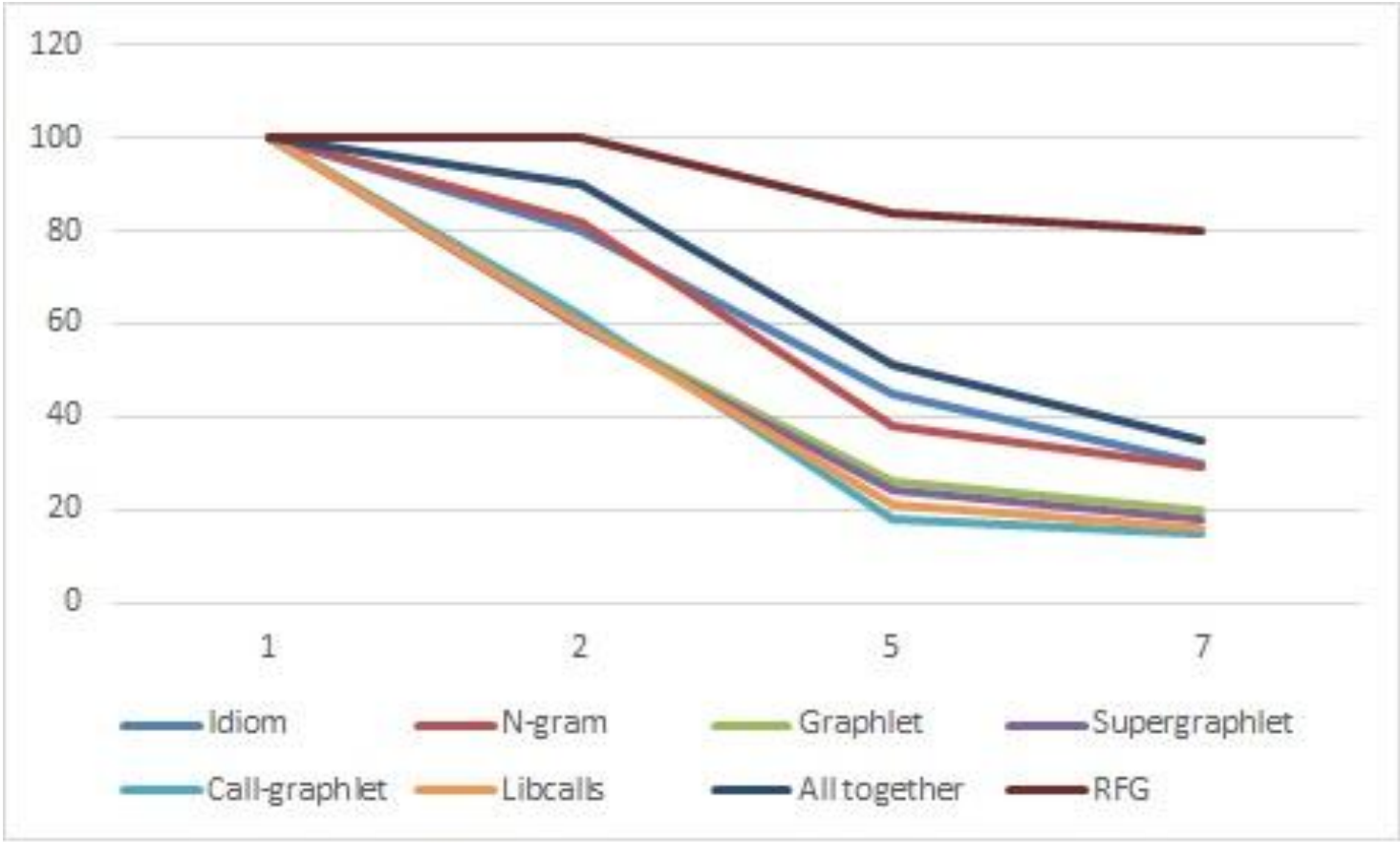
Implementation

- Current state of implementation
  - PostgreSQL & RFG extraction algorithm
  - Preliminary results
    - e.g., for 7 authors x 10 programs
    - 3044 singletons, 10% different roots



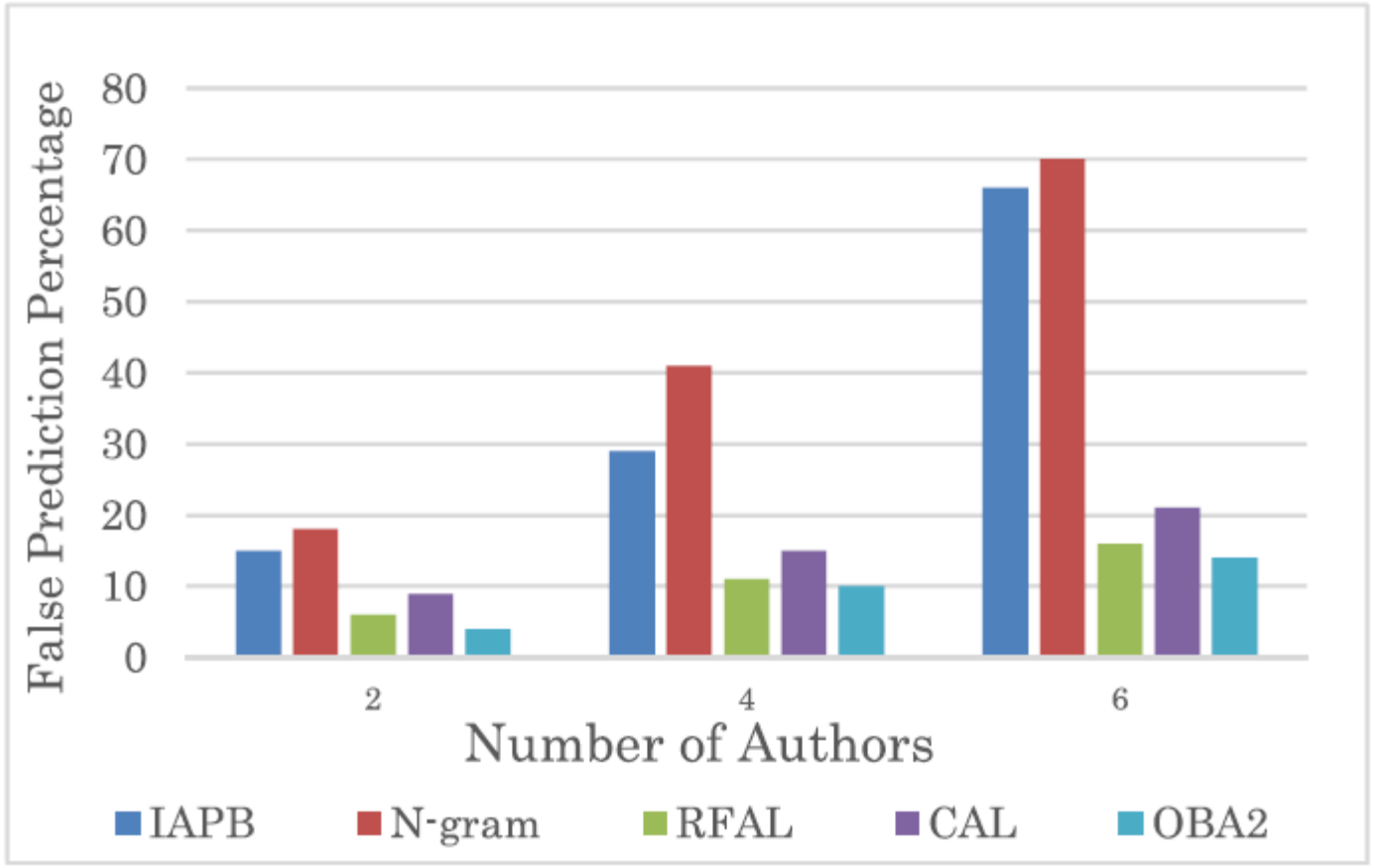
Results

- Accuracy of Features



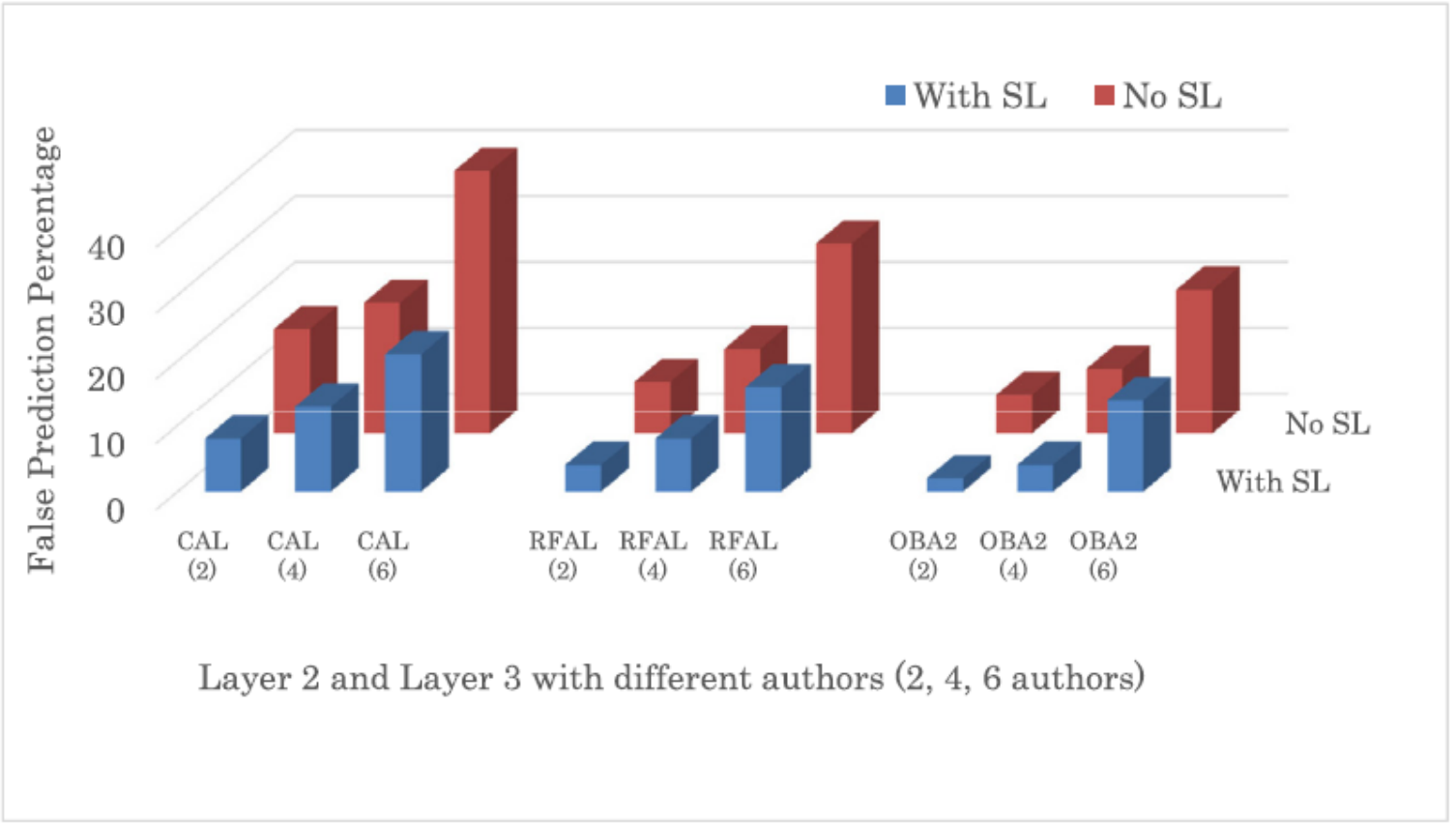
Results

- False Predication



Results

- Effect of Code Filtration



Layer 2 and Layer 3 with different authors (2, 4, 6 authors)

Conclusion

- Authorship attribution framework
  - Code filtration
  - Semantic signatures
  - Plugins for other feature types
- Limitation of Rosenblum et al
  - Filtered Code
  - Meangiful Features
  - Functionality related features
- Future work
  - RFG theory improvement (e.g., CFG)?

Thank You