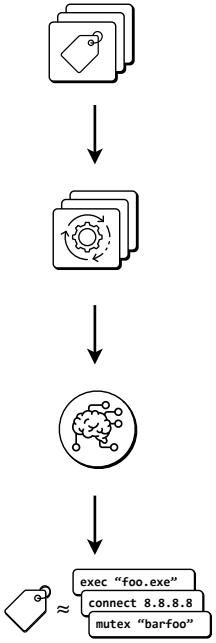
Technische Universität Braunschweig

TagVet: Vetting Malware Tags Using Explainable Machine Learning

Lukas Pirch, Alexander Warnecke, Christian Wressnegger and Konrad Rieck

System Overview



Tagged Malware Samples

Behavior Monitoring

Tag Prediction

Generating Explanations

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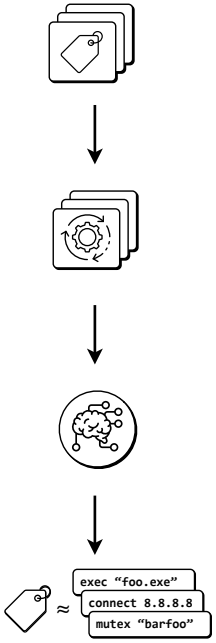

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Behavior Reports - Consolidation

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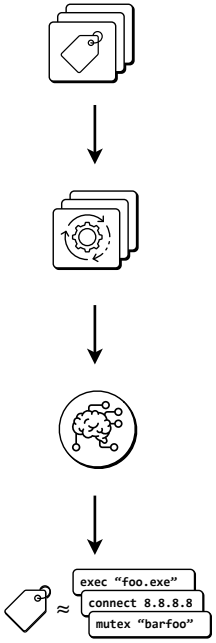

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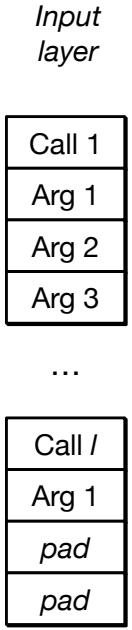
Tag Prediction - CNN



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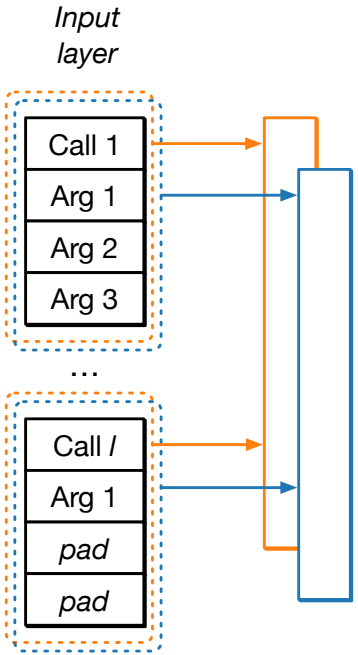

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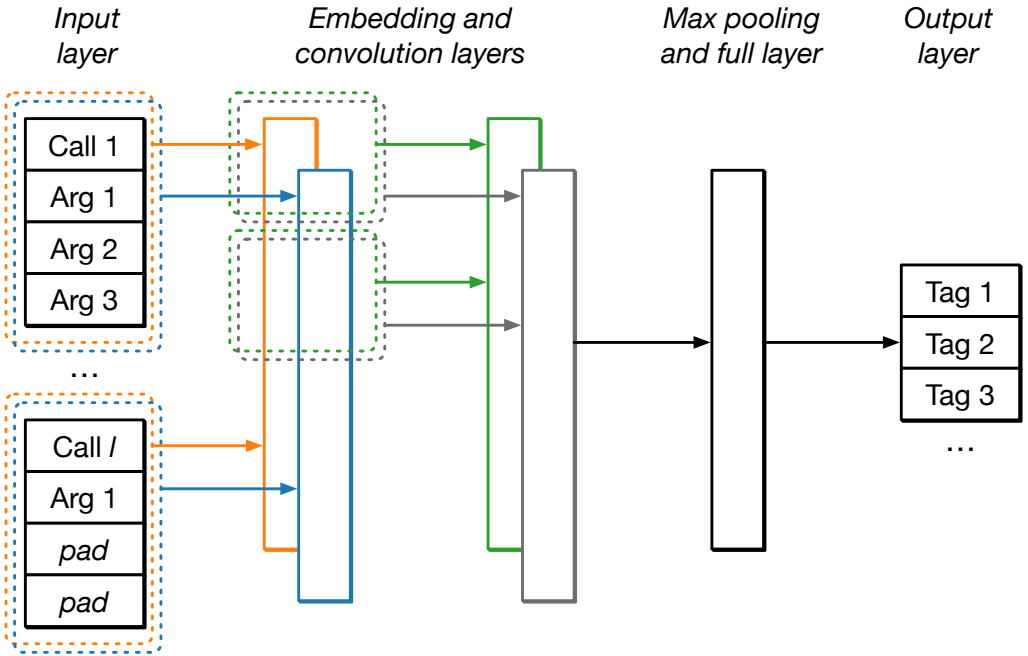

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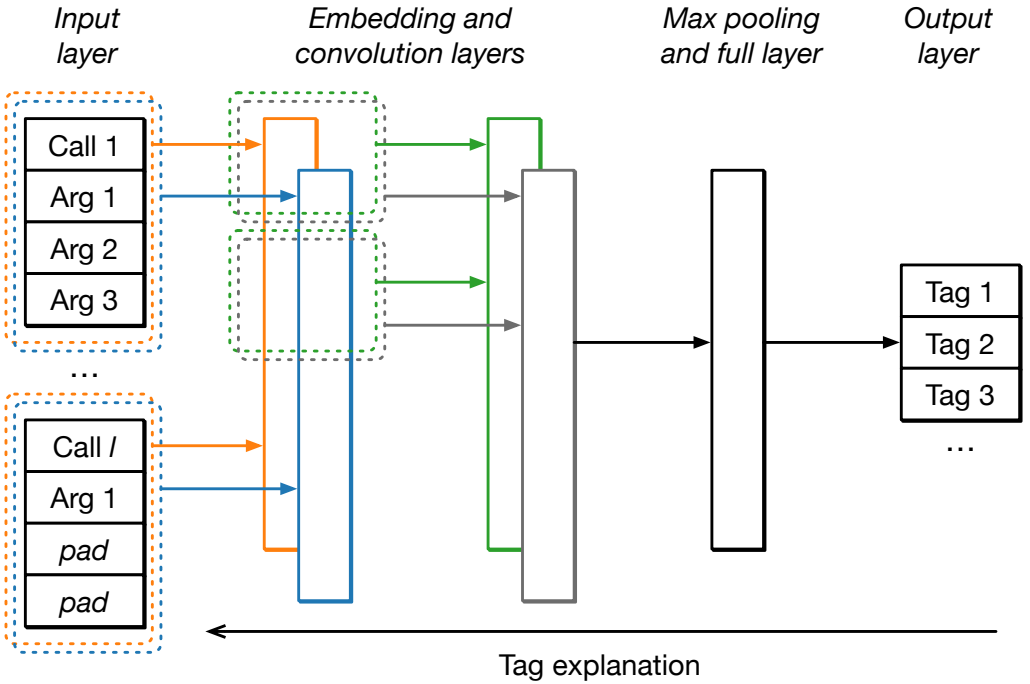

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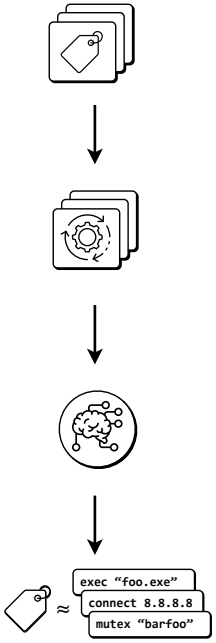

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  - Gradient-based relevance assignment with conservation property

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1	symbol_name	2	createprocess
3	creation_flags	4	create_suspended
5	show_window	6	sw_hide
7	Success	8	true

Generating Explanations

- **Explanation Aggregation**
  - Aggregate relevances per tag
  - Select top k most relevant features across samples
  - Reconstruct context from known XML structure

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Examples

- **Sandbox Tag “Attempts to connect to unavailable TCP servers”**

Id	Tokens in context
1	sck_connect(*)
2	sck_connect(in:post_symbol_name=“connect”)
3	sck_connect(out:success=“false”)
4	sck_connect(in:remote_port=“*”)

Examples

- **Explanation for cluster #17**

Id	Tokens in context
1	mod_map(in:commit_size="0")
2	mod_map(in:zero_bits="0")
3	mod_map(in:protection="page_execute_readwrite")
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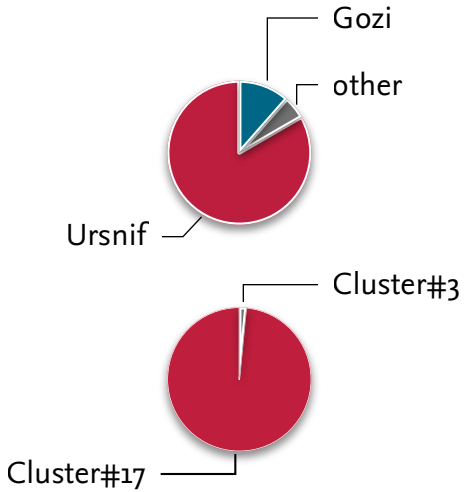

Key Takeaways

- **TagVet explanations help at**
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  - unveiling inconsistencies between different approaches
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  - unveiling inconsistencies between different approaches
  - provide concise and meaningful explanations
- **Inherent limitation:**
  - Discrepancy between behavior-based explanations and the features used by the original tagging

Thanks for your attention!