# Use of AI for Log Analysis in CI/CD Pipelines

Bachelor Thesis - Defence

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FH Oberösterreich · Campus Hagenberg

# Road map

Problem context

Research questions

Method

Architecture

Data & evaluation

Results

Impact

# Problem context

# Why do we care?

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- Manual `grep` slows the merge queue; critical faults slip through.
- Business **Service-Level Objective**: feedback within $\leq$ 200 ms per pipeline.
- Logs may expose customer IDs, therefore they must remain on-premises (no cloud export).

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3. **Latency pressure** - analysis must finish before runner teardown.
4. **Alert fatigue** - regex rule sets grow without bound.

# Research questions

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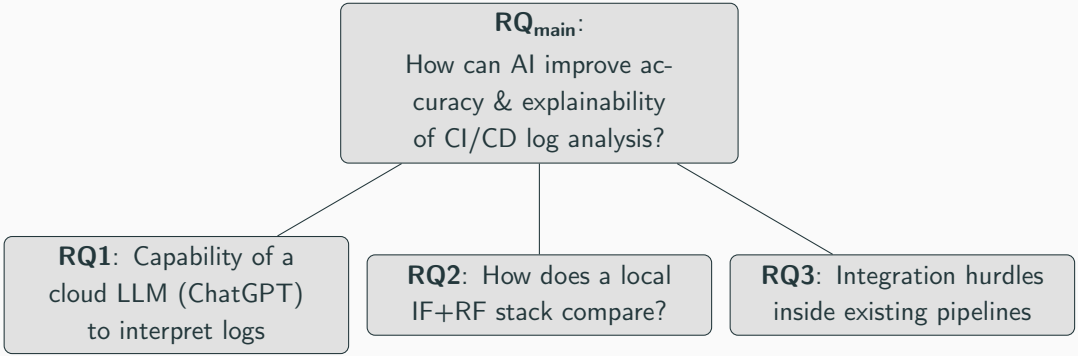

# Method

# Vectorisation pipeline ①

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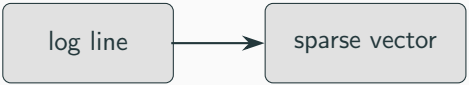

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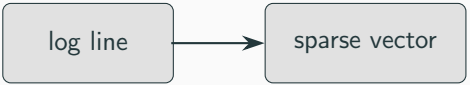

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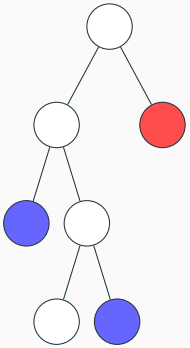
4. Produce 50 000-dimensional sparse vector;
   $> 10^5$ lines / s on one core.

# Isolation Forest ② - intuition

- Random binary partitioning isolates unusual lines in fewer splits.



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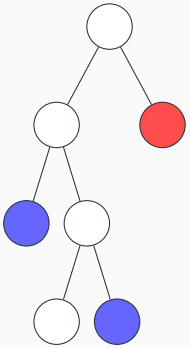

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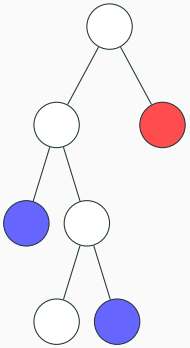
- CPU-only: $\approx 30\,\mu s$ per line.



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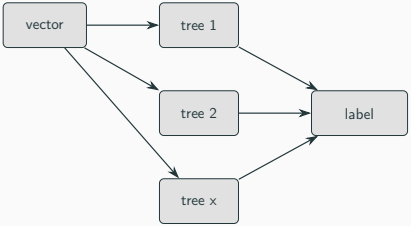

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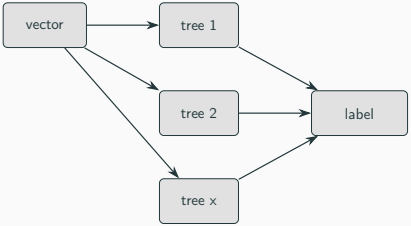

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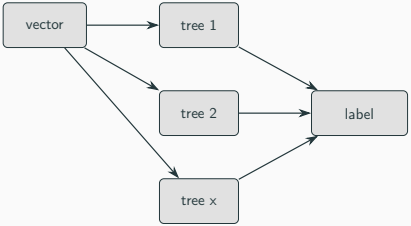
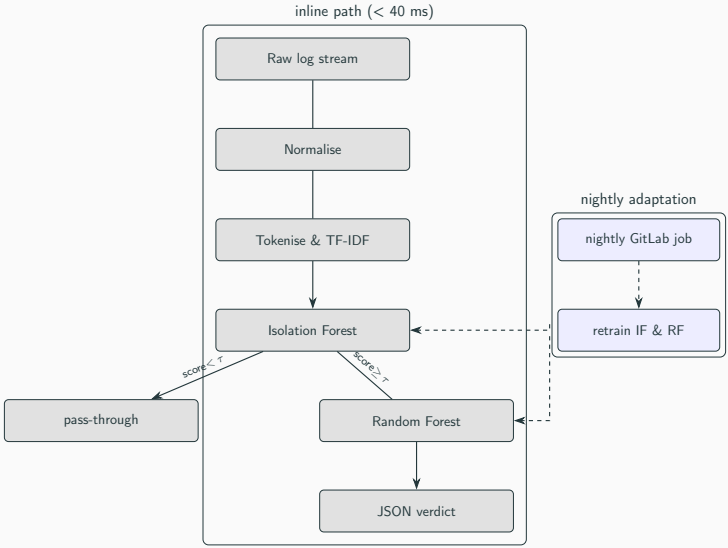
- Nightly retrain $< 90$ s; warm-start handles drift.



# Architecture

# End-to-end pipeline (< 40 ms inline)



# Data & evaluation

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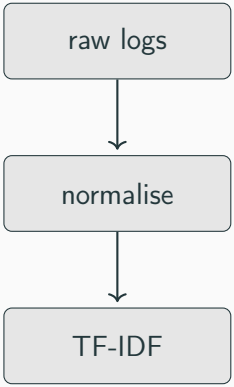
- 117 k *macOS* logs + 655 k *OpenSSH* logs



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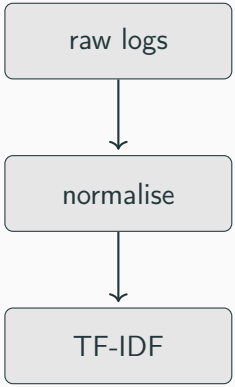

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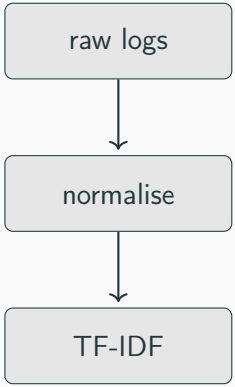

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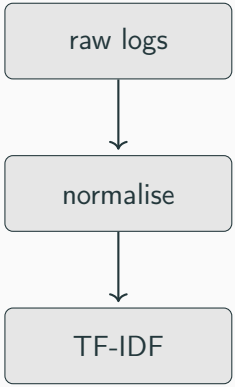
- Metrics: Macro-$F_1$, AUPRC, 99.9th-percentile latency



# Results

# Headline numbers

| | Precision | Recall | $F_1$ |
|---|---|---|---|
| Detection (Isolation Forest) | 0.91 | 0.88 | 0.89 |
| Classification (Random Forest) | 0.99 | 0.99 | 0.99 |

Throughput: 45 000 lines/s | 99.9th-percentile latency: 37 ms

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- **Cost-free**: 2.3 k lines of code, CPU-only, no token fees.
- **GDPR compliant**: logs never leave the VPN.

# Wrap-up

# Take-away

**Light-weight on-prem ML matches AIOps SaaS**

without latency, cost or privacy pain.

Questions welcome - thank you!