ICEPP
The University of Tokyo

Subqubo-size dependency

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Configuration

create_dataset

- density : 10%
- pt_cut : 1[GeV]
- seed : fixed
- minimum_hit : 8

QUBO model

(1) Qallse_d0

(2) Qallse_doublet (Doblets-based model implemented by Masahiko)

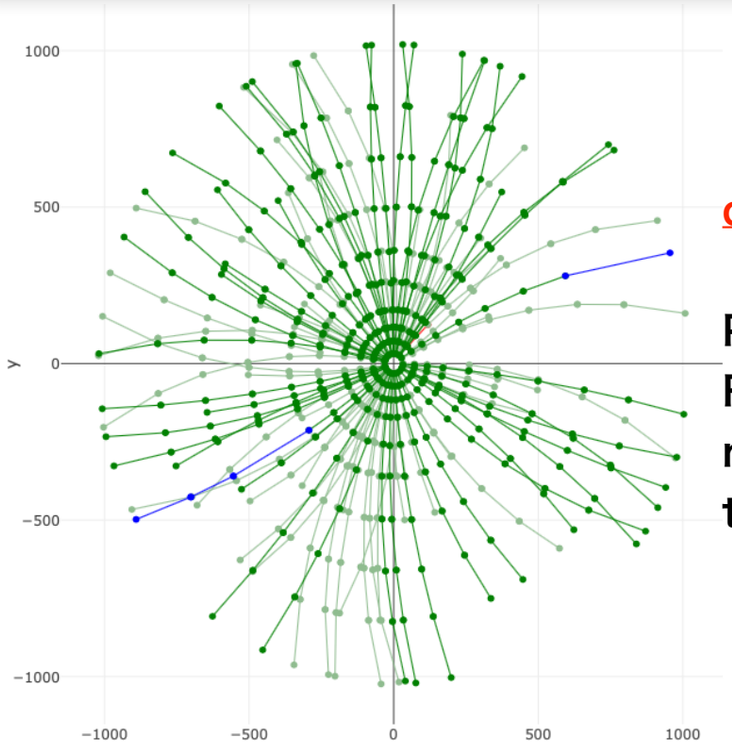
QUBO solver

(1) neal

(2) qbsolv without D-Wave

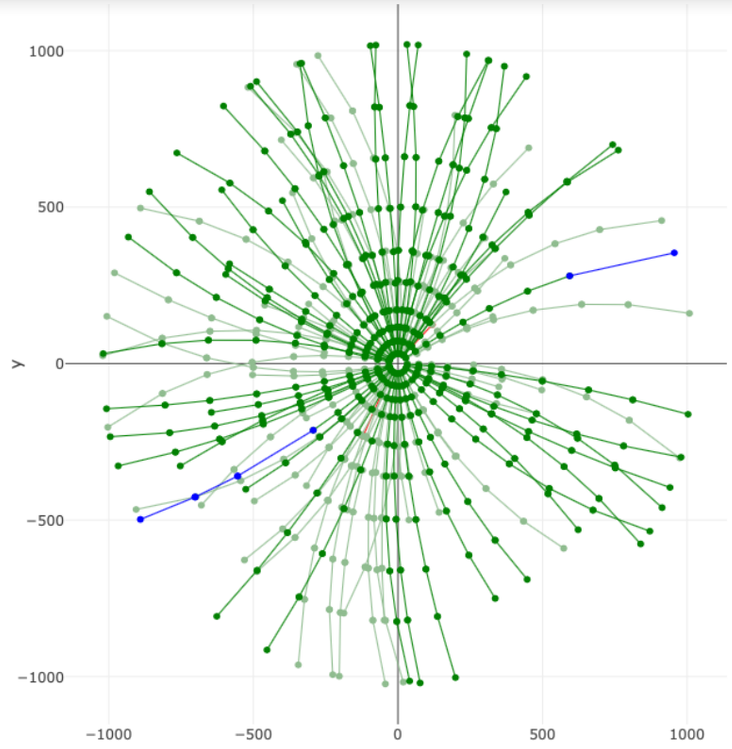
→ Compared the performance of (Qallse_d0, Qallse_doublet)×(neal, qvsolv) results

Results



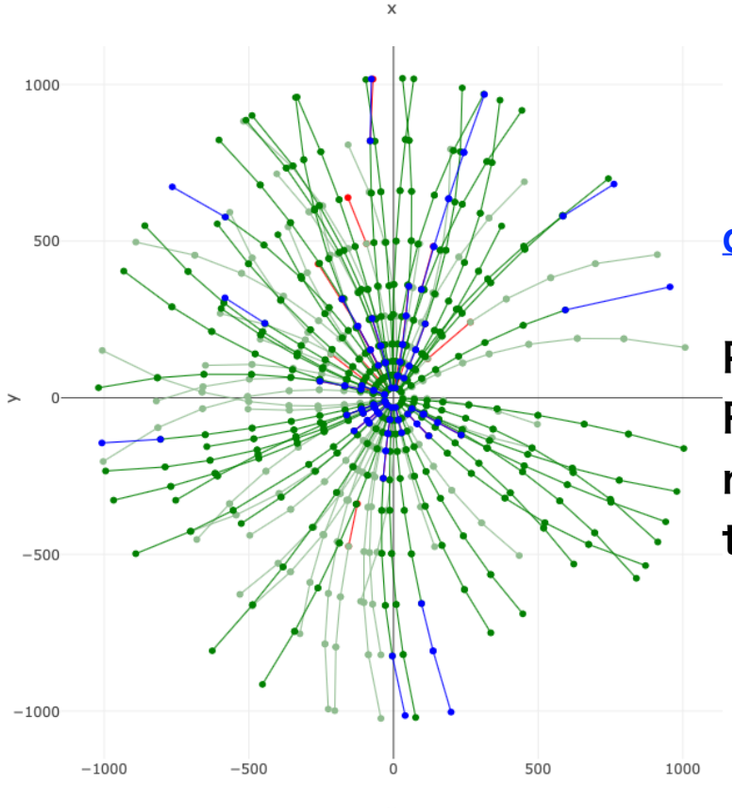
d0_neal

Precision : 99.7%
Recall : 99%
missing : 4
trackML score : 99.1%



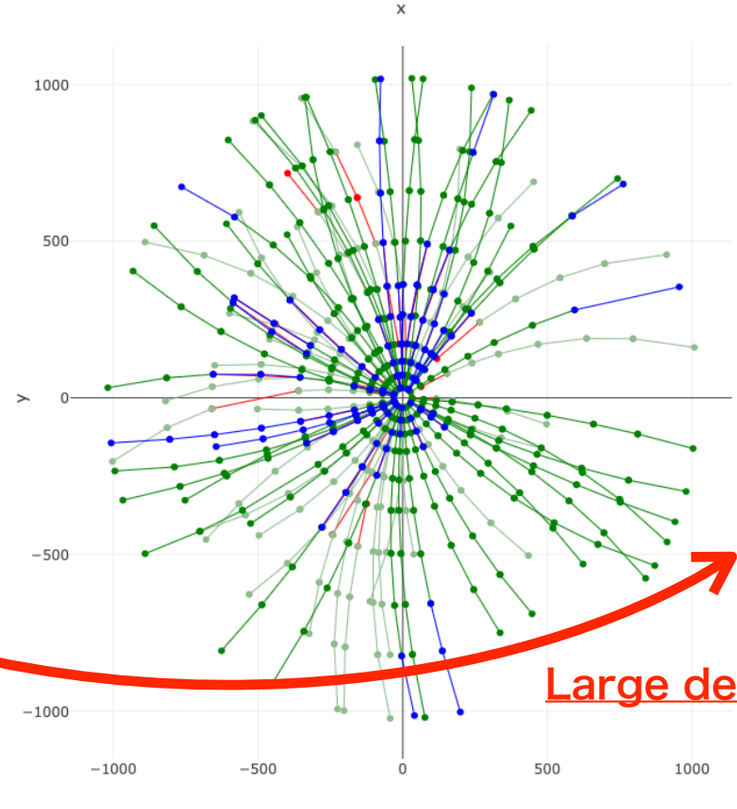
d0_qbsolv

Precision : 99.5%
Recall : 99%
missing : 4
trackML score : 99.1%



doublet_neal

Precision : 91.1%
Recall : 87%
missing : 52
trackML score : 87.9%



doublet_qbsolv

Precision : 85.4%
Recall : 76.3%
missing : 95
trackML score : 75%

Large degradation

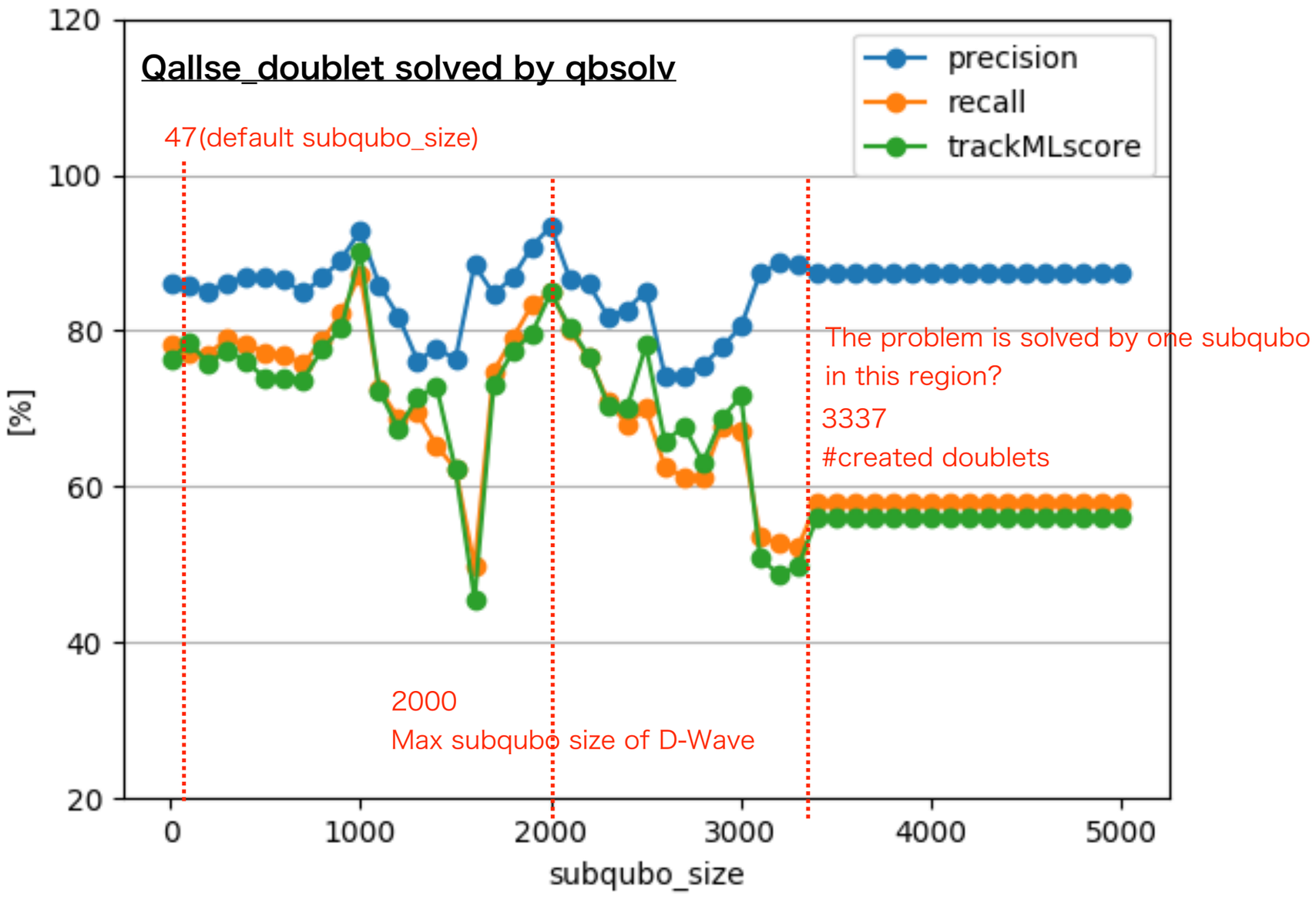
・Doublet model shows the significant difference between “neal” and “qbsolv”
(The other configuration is exactly same)

Subqubo-size dependency

Qallse_doublet has many connections between doublets

→ Subqubo-size in qbsolv affects the results?

→ Checked **subqubo size (maximum variables in a subqubo) dependency**



- Large fluctuation between 1000~3000 (why?)
- Flat performance from 3337(#created doublets), but “recall/trackMLscore” are worser than default value (47)

Summary

Performance comparison of (Qallse_d0, Qallse_doublet)×(neal, qbsolv)

- Qallse_doublet solved by qbsolv shows the degradation compared to neal

Subqubo-size dependency

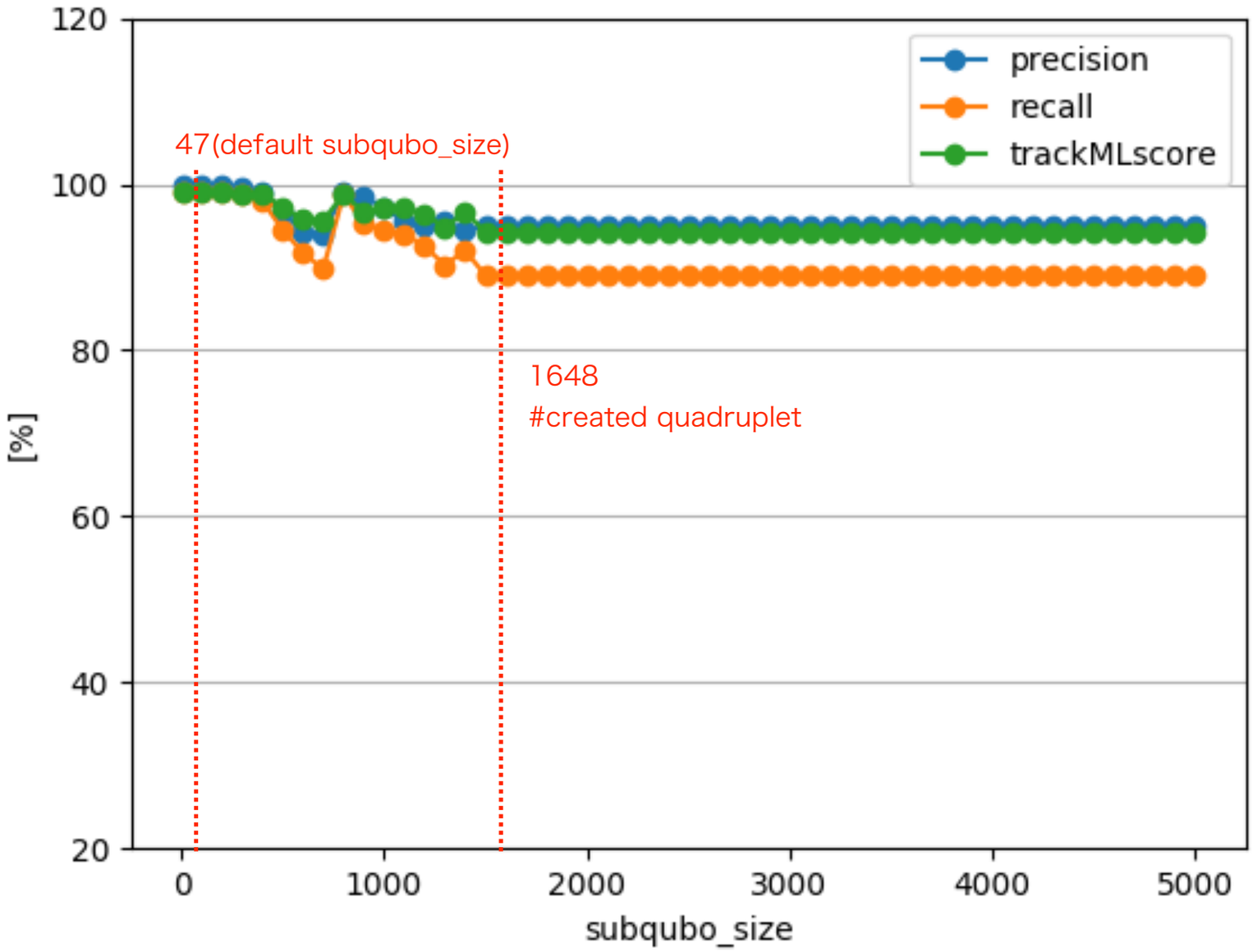
- Qallse_doublet has many connections between doublets
  → Vulnerable to subqubo splitting?

- Checked subqubo-size dependency
  → Smaller subqubo-size (around default value :47) shows better performance
  → Larger subqubo-size (larger than #doublets) shows similar precision performance, but recall/trackMLscore is decreased

- Splitting into several subqubos might show better performance in some QUBO model? Number of connections and minor-embedding are related?

Backup

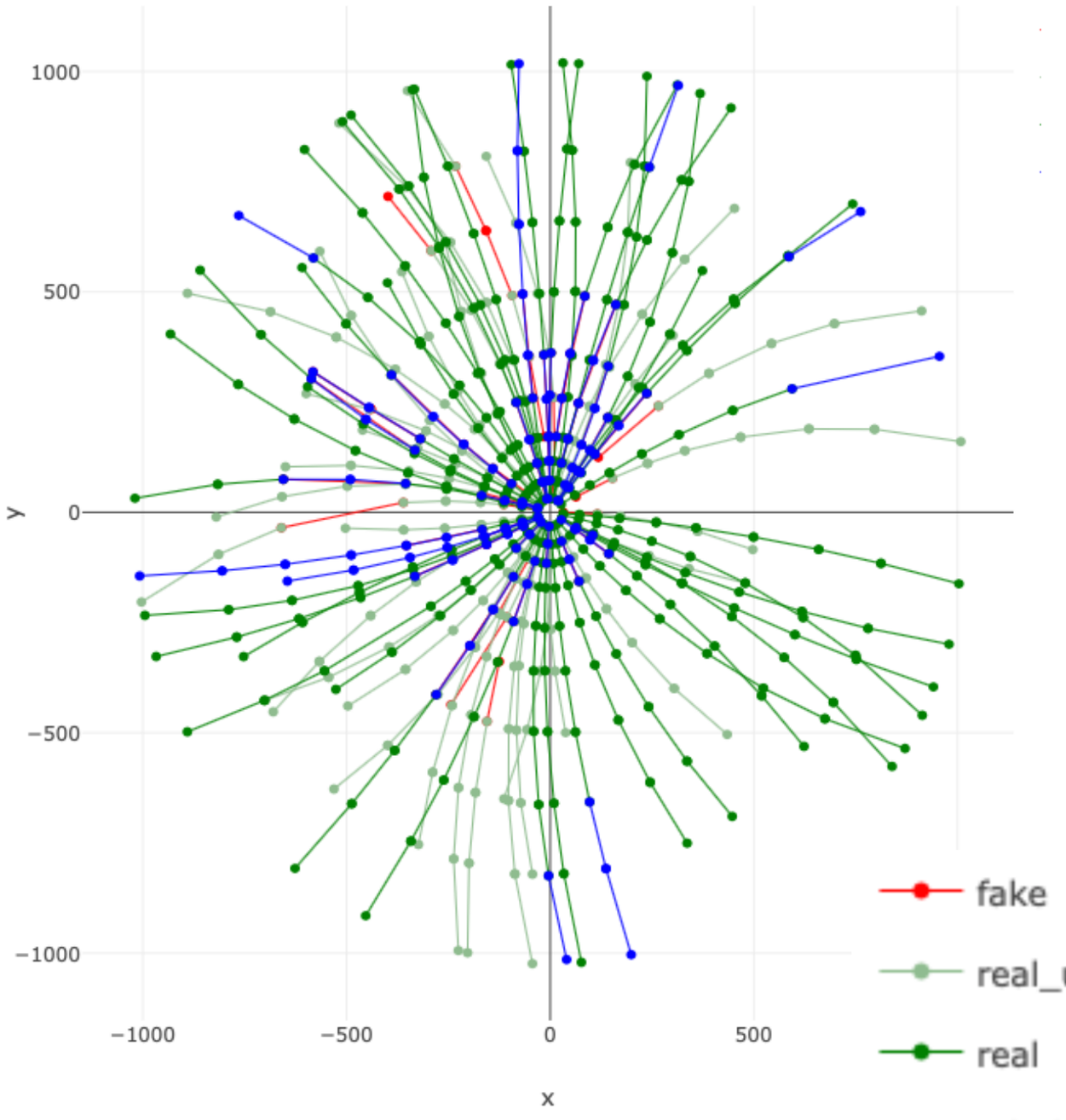
Qallse_d0 (quadruplet-based model)



- Similar dependency
- Only “recall” is degraded

Plots

subqubo_size=47



subqubo_size=5000