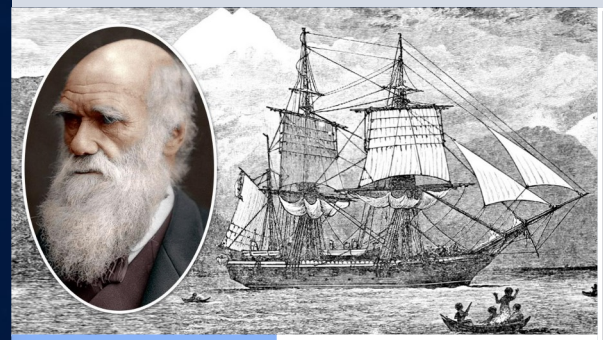
Diversity Optimisation

Markus Wagner, markus.wagner@monash.edu

200 years ago, Charles Darwin…



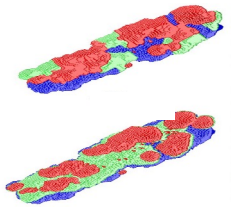
Galápagos Islands
Islas Galápagos
4.6 ★★★★½ 2,344 reviews
Archipelago

Four of Darwin's finches, clockwise (from top left): *Geospiza magnirostris*, *Geospiza fortis*, *Certhidea fusca*, *Camarhynchus parvulus*

…each species is doing well
in its niche → “equally good”

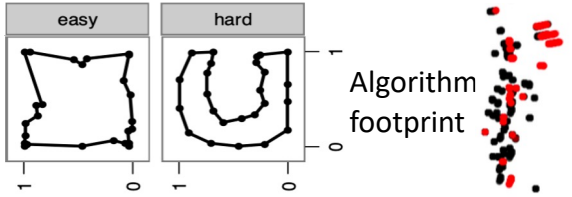
Diversity nowadays: show alternatives

Power grid restoration
optimise w.r.t. known objectives (money, time, …), but then show alternative plans (e.g. sequences, …)



Inspirational image generation
optimise quality & similarity to a seed, but be diverse (search the latent space)

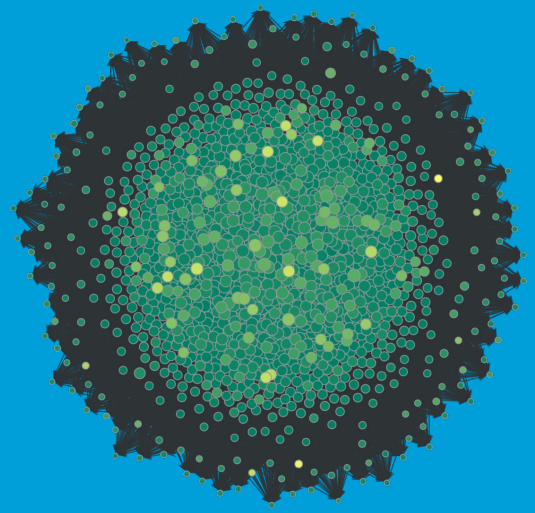
Algorithm understanding / algorithm tuning / algorithm portfolios / …
generate X instances (*diverse* w.r.t. features) on which Z algorithms perform *differently*



Socialz: Multi-Feature Social Fuzz Testing

Supported by
Facebook/Meta

In Collaboration with
Francisco Zanartu (UAdelaide) and
Christoph Treude (UMelbourne)



https://arxiv.org/abs/2302.08664
https://github.com/fzanart/Socialz

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5 Annoying Social Media Bugs

Charlotte Day
Creative Director - Contentworks Agency #ContentMarketing Strategist

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May 19, 2015

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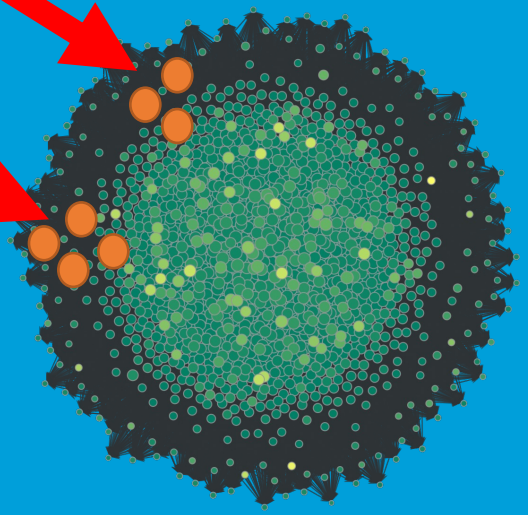
ars TECHNICA

TRUTHS AND RETRUTHS —

Trump's social app marred by bugs and apparent ban on Devin Nunes cow accounts

Trump's social network technically exists now, but good luck trying to use it.

JON BRODKIN - 2/24/2022, 7:49 AM



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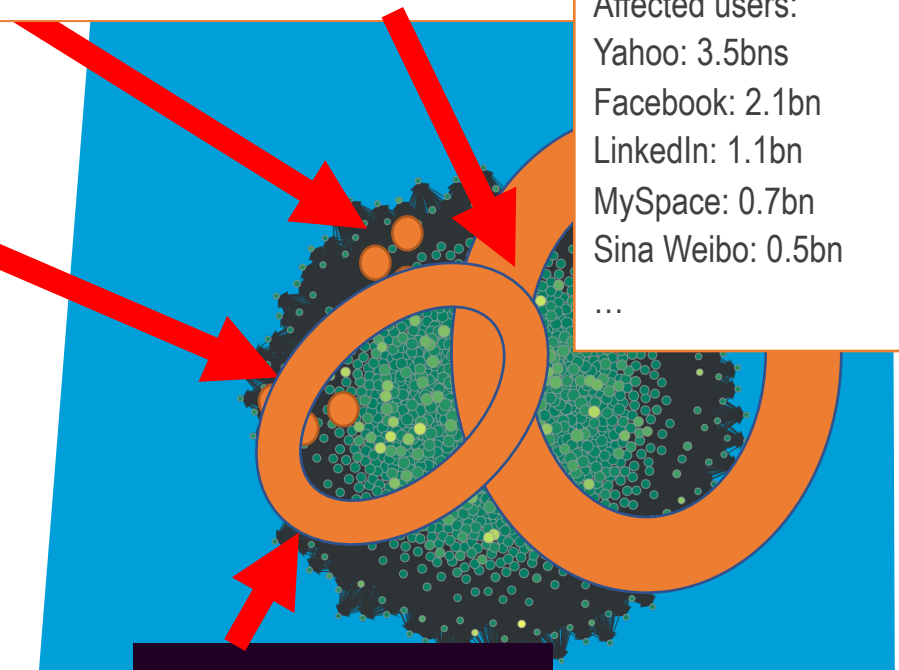
BUSINESSPLUS

SCIENCE & TECHNOLOGY / 5TH NOVEMBER 2022 / GEORGE MORAHAN

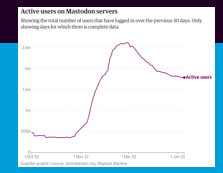
Data breaches have become a hazard of being on social media, but some websites are worse at handling our data than others.

In Ireland alone, the Data Protection Commission received notifications of 6,549 data breaches last year and issued a fine of €225m to Meta-owned WhatsApp over a range of compliance failures.

Affected users:
Yahoo: 3.5bns
Facebook: 2.1bn
LinkedIn: 1.1bn
MySpace: 0.7bn
Sina Weibo: 0.5bn
…



mastodon



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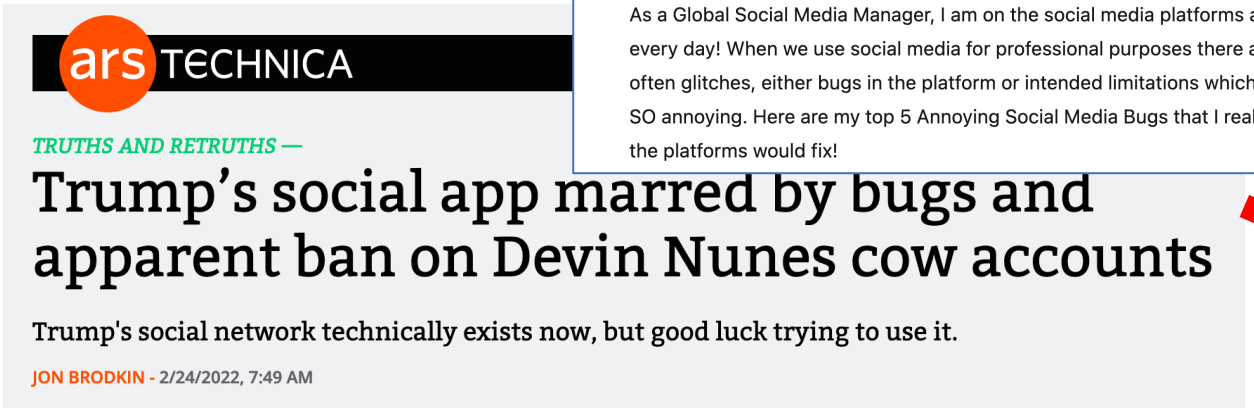

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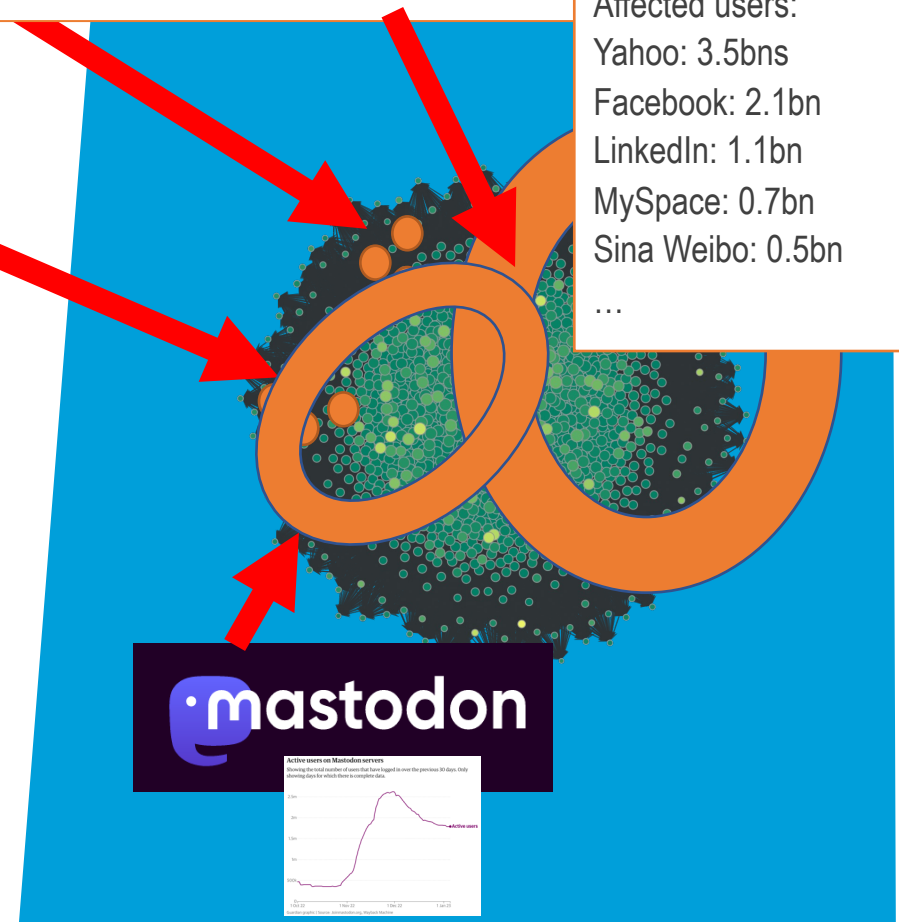

How to discover bugs (using testing)?

- Unit testing

…

- System testing: typically the ‘journey’ of a single user
- **NEW: social testing**, because increasingly, bugs are the result of complex interactions

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Diversification of Interaction

GitHub: COBOL, 2011-2016,
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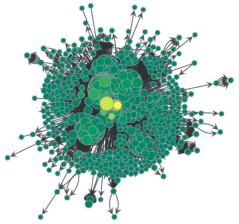

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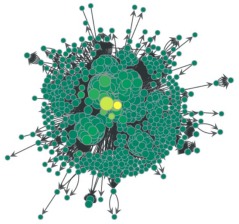
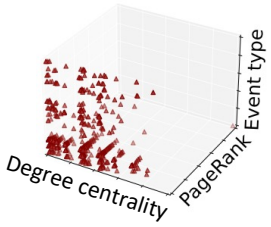
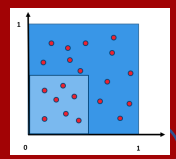




Diversification of Interaction

Star discrepancy: measures the regularity with which points are distributed in boxes anchored in the origin



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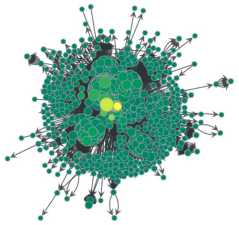

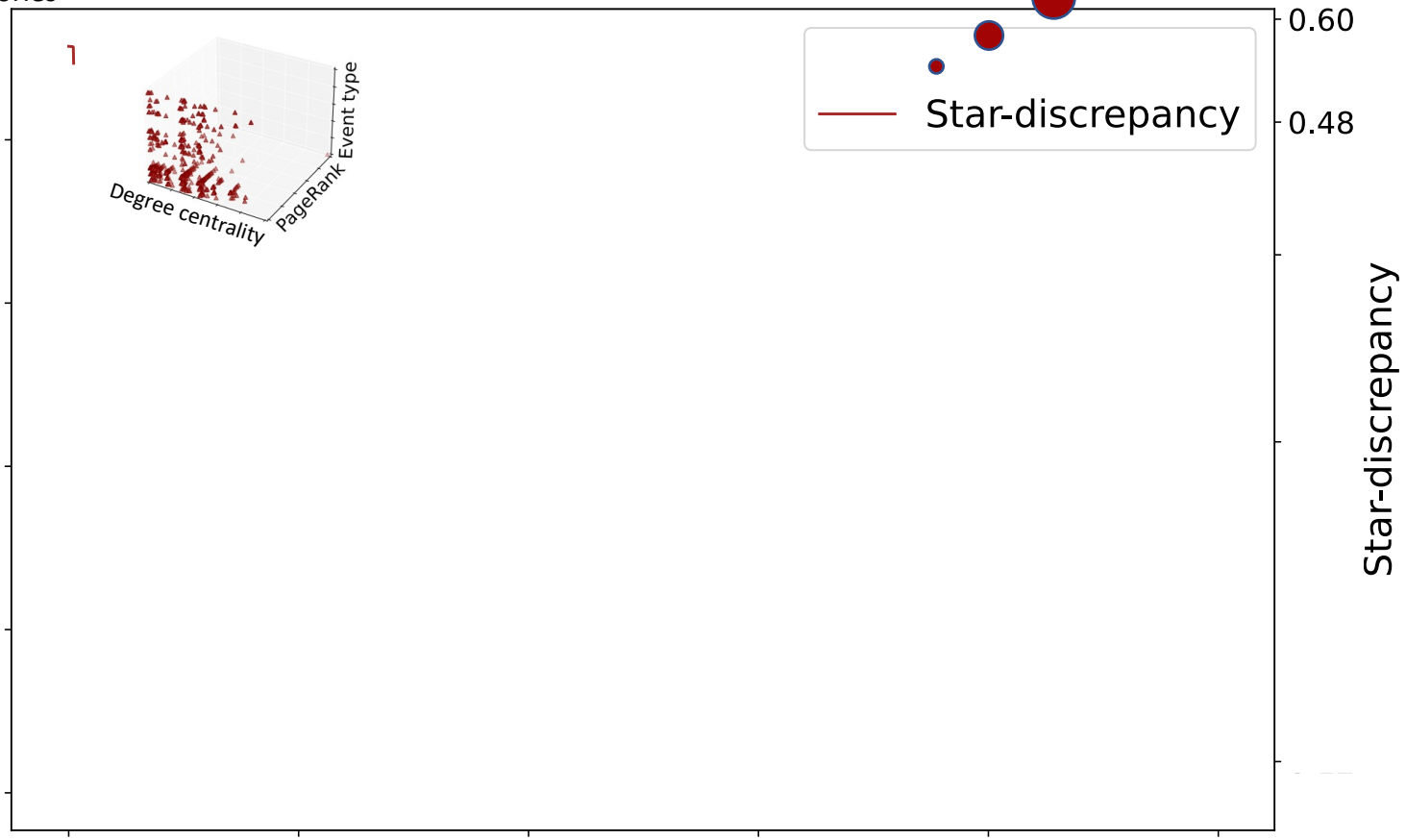

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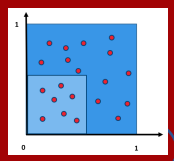

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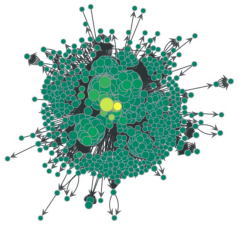

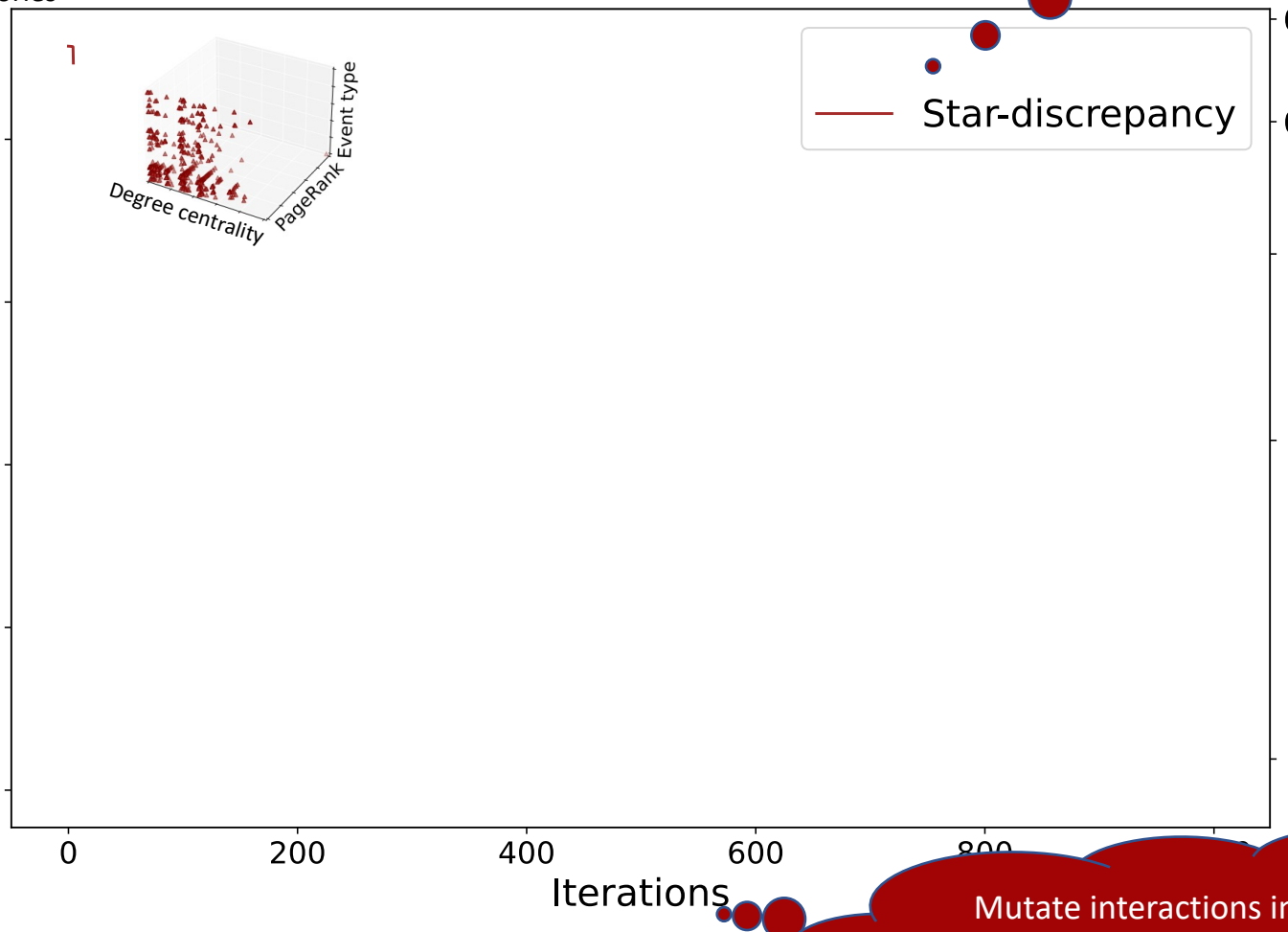

Mutate interactions in the graph
➔ If diversity improves, then keep the new graph for the next iteration.

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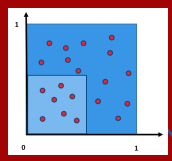

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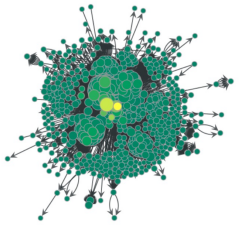

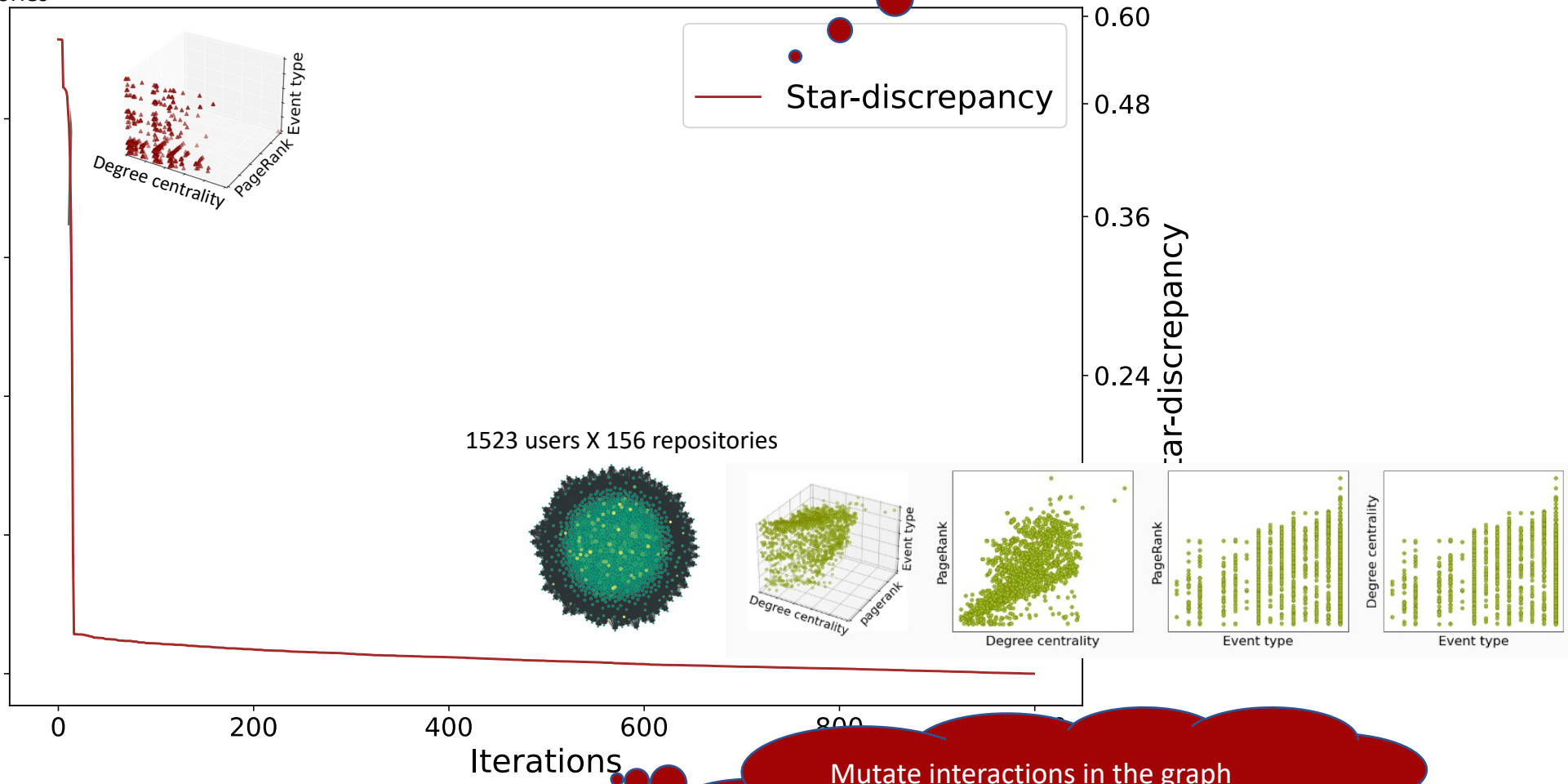

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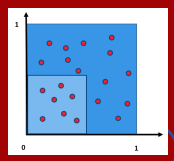

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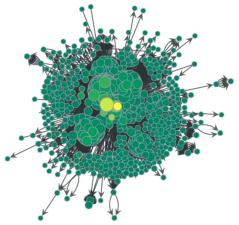

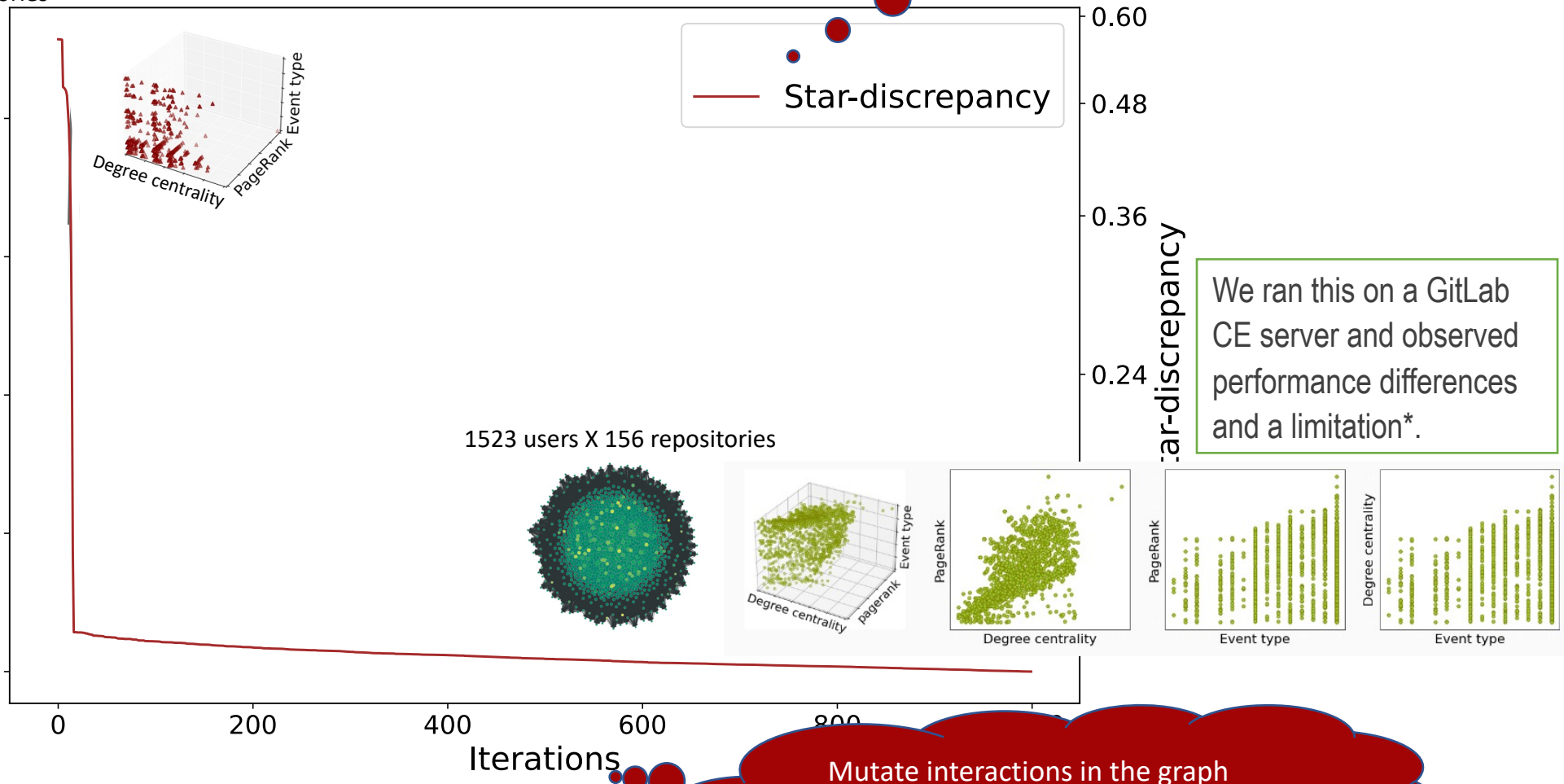

We ran this on a GitLab CE server and observed performance differences and a limitation*.

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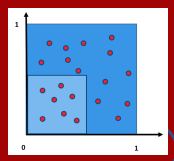

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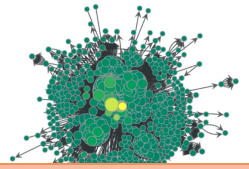

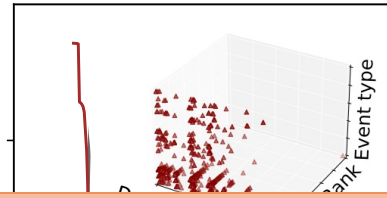

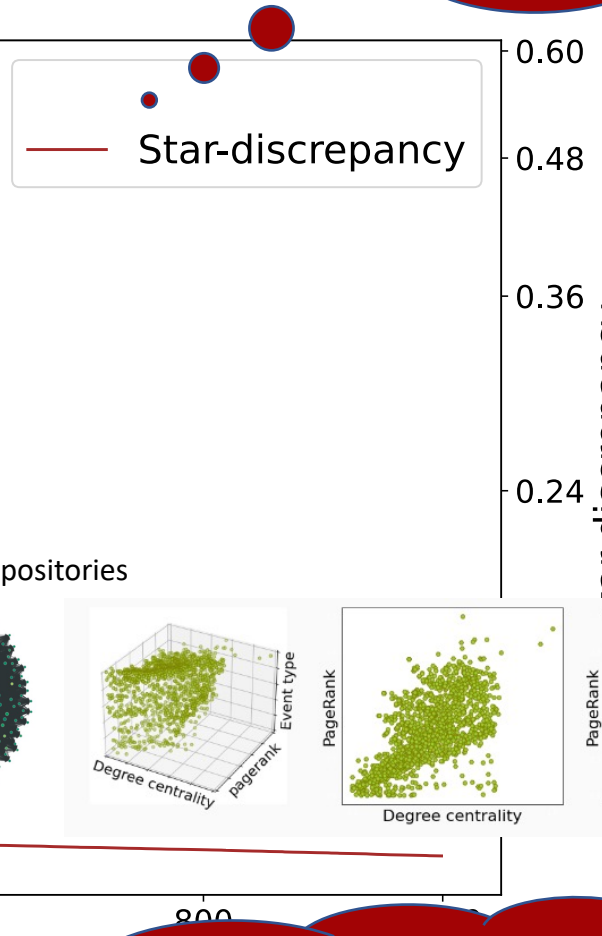

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Some other "real" projects

- Creating human-like summaries: aim for a single target vector in the "text characterisation space" (w/ CT and Mahfouth Alghamdi)
- Rewriting Software Documentation for non-native speakers (w/ CT and Wencuan Poh; Google-funded)
- debunk climate change misinformation (more effective debunking by considering the reader's age, educational level, political affiliation, …)

Some other "academic" projects

- Create performance-diverse instances and characterise them (e.g. features of hard/easy)
- Create feature-diverse sets of instances
- Create performance-discriminating instances (for sets of algorithms)

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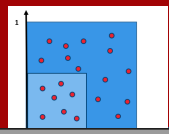

Do you want to "diversify" something?
All you need are two components:

- A way to generate "mutants" of what you have
- A way to characterise (features and/or qualities) the mutants

With this in mind, a simple (possibly population-based) approach will do the job.

➔ Ask me if you have questions on how to formulate something; markus.wagner@monash.edu

(Some historical overview: http://acrocon.com/~wagner/pub/210907diversityIEEEQueensland.pdf)

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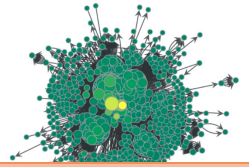

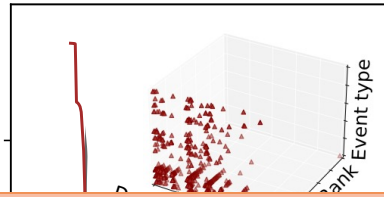

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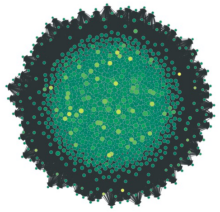

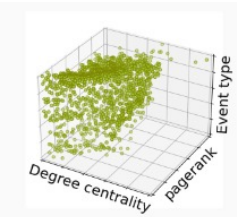

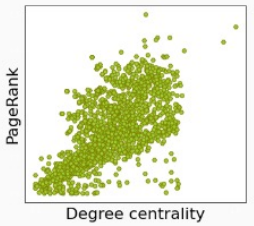

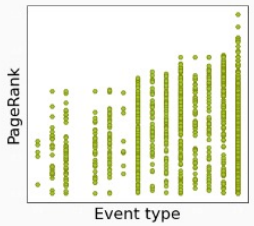

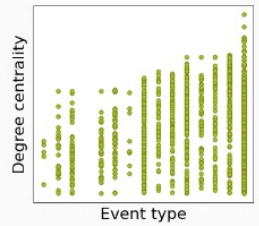

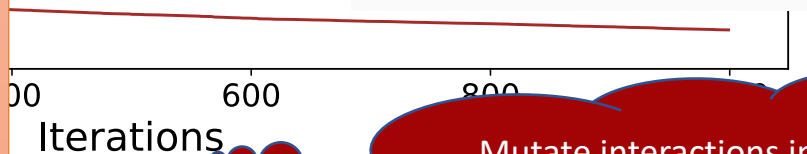

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