# t-SNE: Assisted Parameter Optimization by Approximating Neighbourhood Similarity

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# I. Motivation

- Context: Master thesis on PSA for word embeddings
  - How to visualize single WE model with all records?
  - Reduce dim. with t-SNE to $d_{low} << d_{high}$ so that $d_{low}$ can be reasonably interpreted in a SPLOM
  - How to choose hyperparameters for t-SNE?

- Constraint: DR is implicit step in the pipeline; user shouldn‘t have to invest cognitive effort

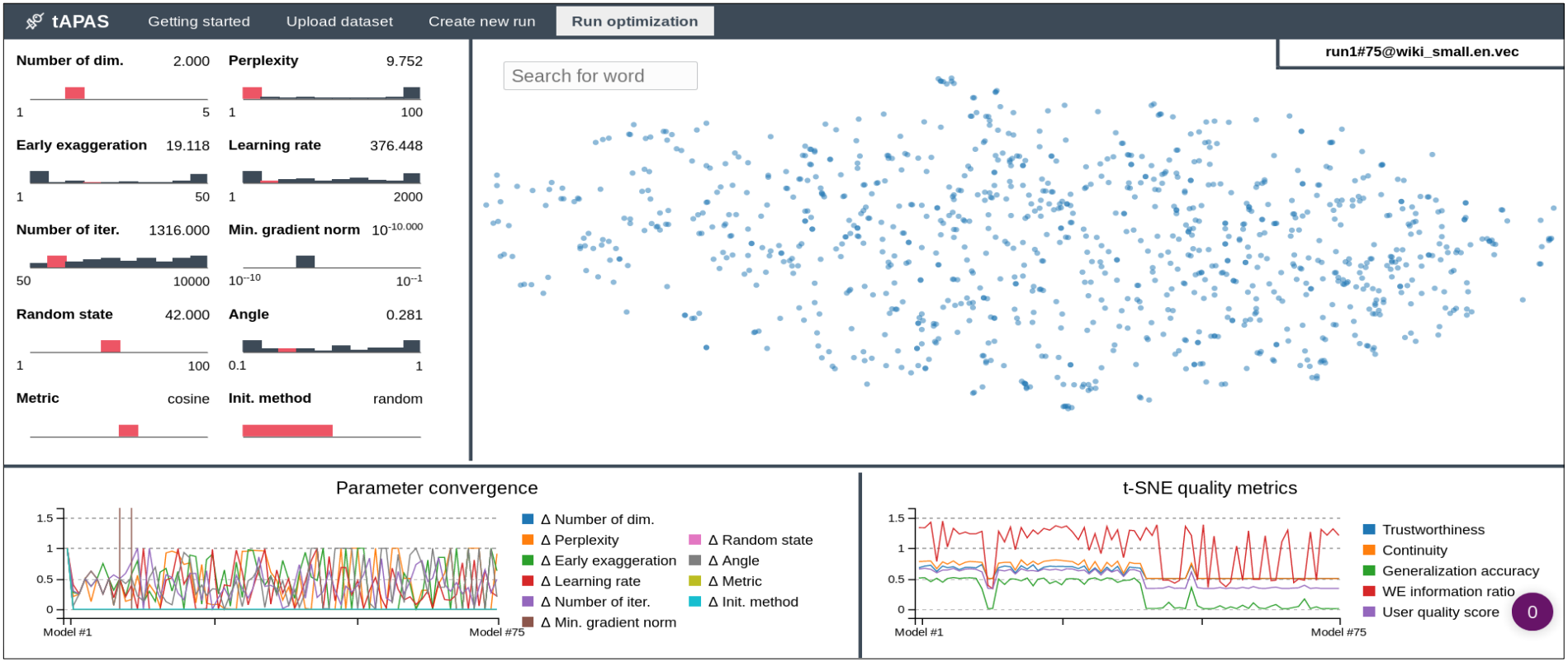
# II. Approach

- Hyperparameter optimization:
  - Grid search, random., *Bayesian,* grad.-based, evolutionary, ...
- Questions:
  - How fast does BO converge?
  - Does it yield useful results for t-SNE?
  - Exploration vs. exploitation
- Build application tracking BO of t-SNE for word embeddings; evaluate efficacy and convergence behaviour

# III. Concept & Prototype

- Different quality metrics (weighted average):
  - Faithfulness to original topology
  - Usefulness for domain tasks
- Plot convergence of hyperparameters and evolution of quality metrics
- Enable user to assess model quality; suggest rating

# III. Concept & Prototype



# IV. Evaluation

- Results so far show no consistent (positive) tendency – more runs & metric tuning necessary
- Exploring dimensionality reduction algorithms warrants dedicated investigation. Thus: Abandon original idea for thesis in favor of VPSA for DR algorithms

# V. Future Work

- With better understanding of t-SNE after VPSA for DR: Re-evaluate design; improve prototype of optimization UI
- Investigate exploitation vs. exploration parameters for BO
- Ultimately: No need for human in the loop, providing BO for optimization of DR/t-SNE in the context of WE automatically

# References


- [1] https://github.com/rmitsch/tapas
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- [4] J. A. Lee and M. Verleysen, “Quality assessment of dimensionality reduction: Rank-based criteria,” Neurocomputing, vol. 72, no. 7, pp. 1431–1443, Mar. 2009.