A practical approach of different programming techniques to implement a real-time application using Django

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Motivation

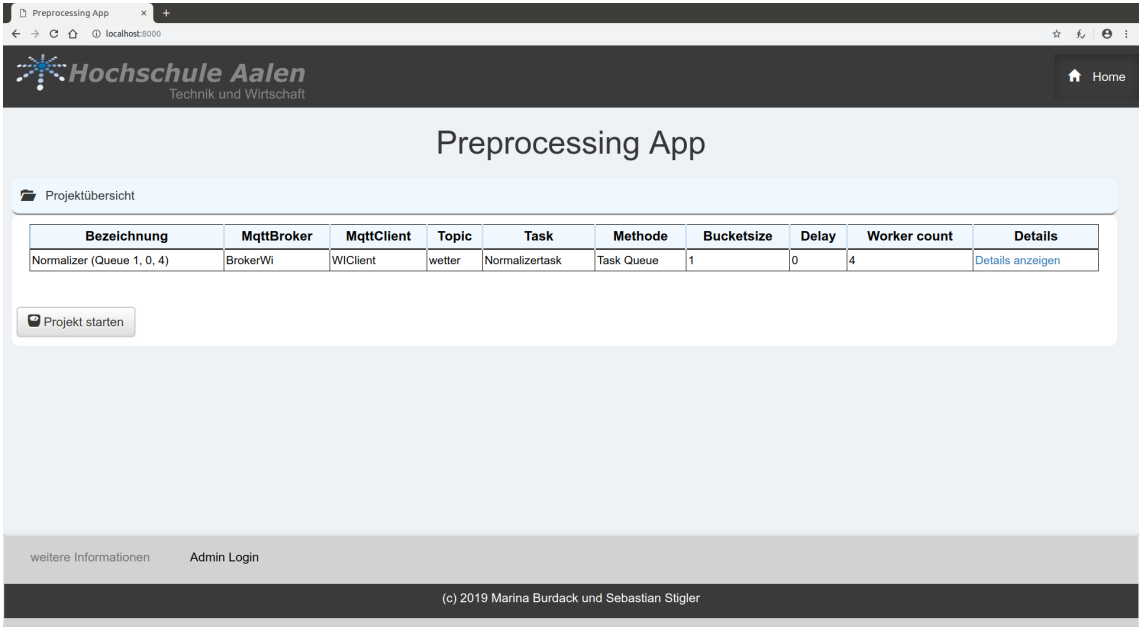
Aims for the Django Application

- How far do we get with an Python only approach?
- Tool to configure and run DA / ML pipeline
  - Datasource
  - Preprocessing Tasks
  - Machine Learning Tasks
  - Presentation of the Result

The Focus of this Paper

- The preprocessing part of the pipeline.
- How does our application scale?
- What are the knobs we can use to scale the application?

Preprocessing App (in german)



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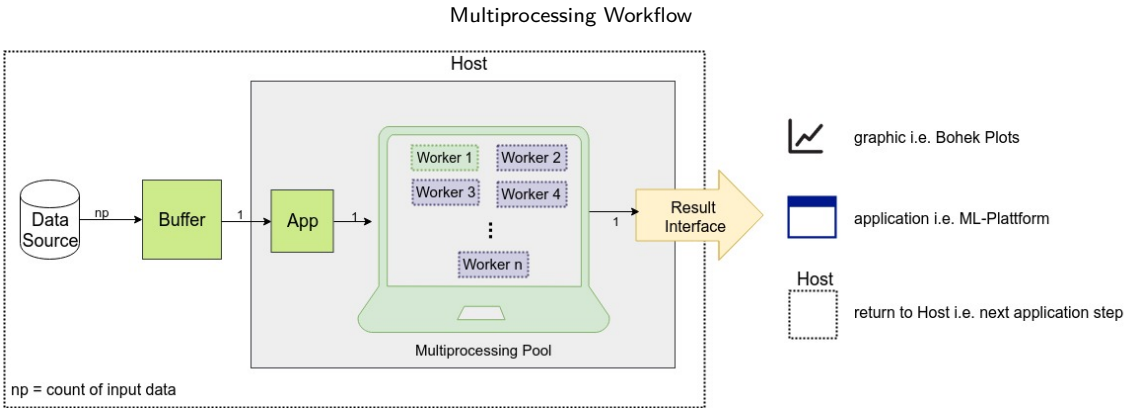
Methodology

Types of Scaling

- Singlethreaded ✗
- Multithreaded [4, 8] ✗
- Multiprocessing ✓
- Distributed Task Queue ✓



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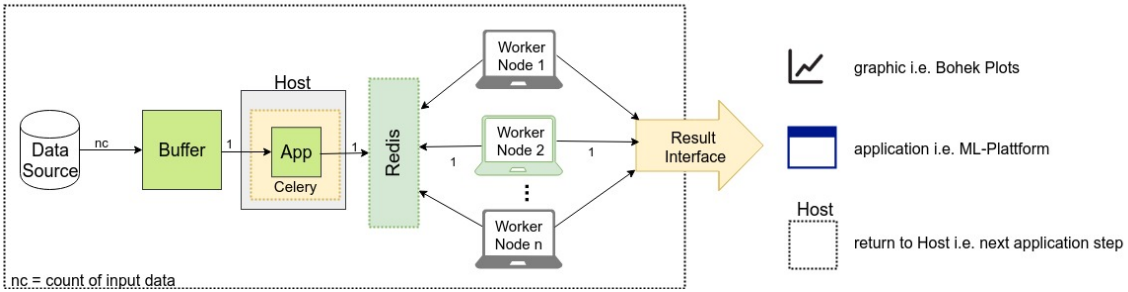
The Multiprocessing Pool is realized with the `ProcessPoolExecuter` Class of the `concurrent.futures` module [5] from Python 3.7's Standard Library.

Task Queue

Celery Workflow



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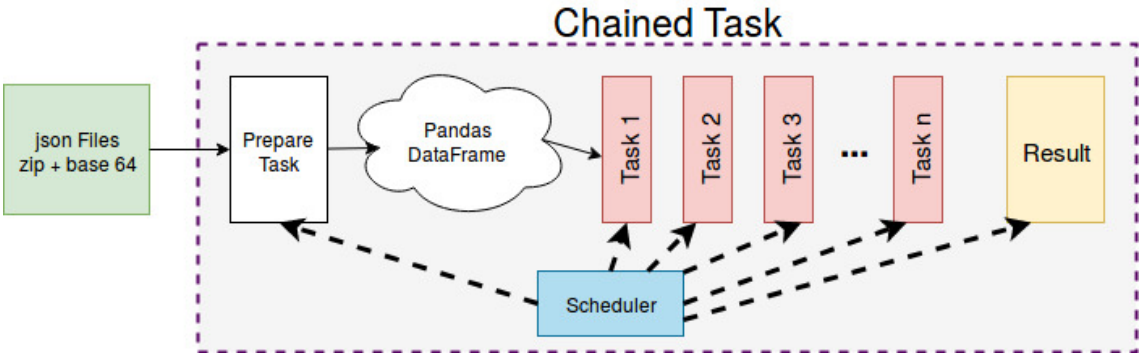
The Task Queue is realized with `Celery` 4.3 [7] and Redis [6].

Structure of a chained Task

Processing of a chained Task



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Queueing Theory [1]

A queue with c servers is **stable** (won't grow without bound) if the following equation holds:

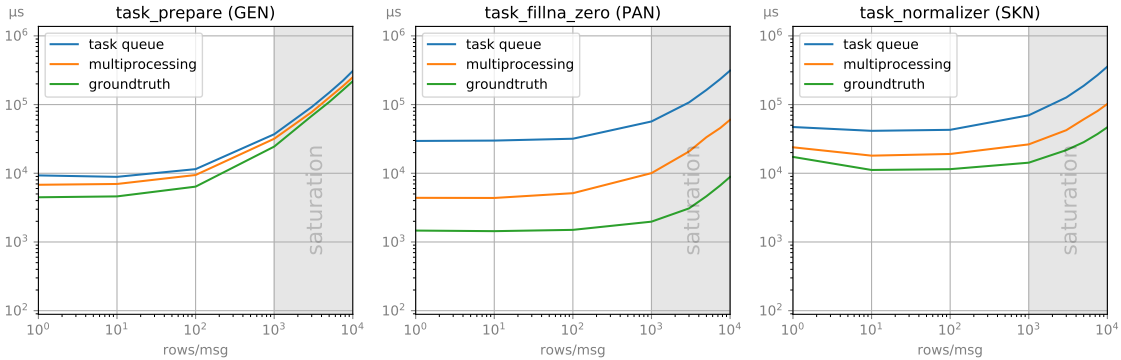
$$\rho = \frac{\lambda}{c\mu} < 1 \tag{1}$$

Where ρ is the server utilization, λ is the arrival rate and μ is the service rate (the inverse of the service time) for one task.

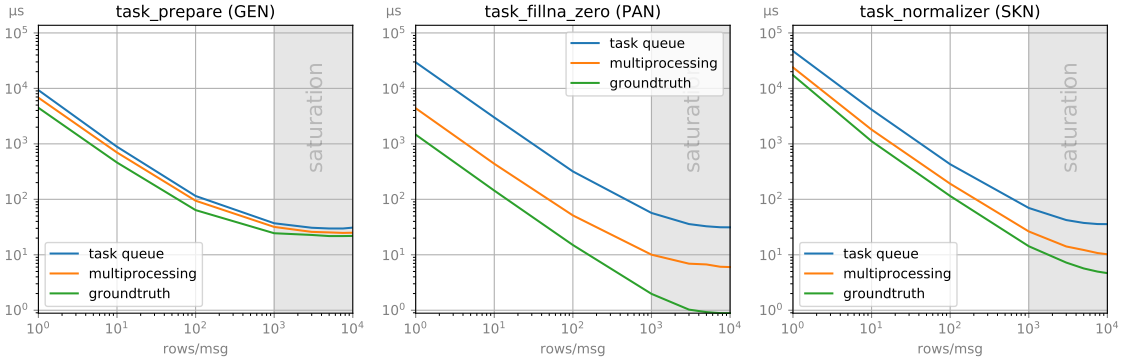
Evaluation

- 750'000 Measurements (***rows***) from a Davis Weatherstation
  - 33 value/row in total
  - 26 of them with numerical values
- 75 – 750'000 Messages (***msg***) are the output of the buffer with a rows/msg rate from 10000 down to 1
- 16 Subtasks
  - Prepare and Result Task
  - 6 Tasks which directly uses methods from Pandas [3]
  - 8 Tasks which uses preprocessing methods form scikit-learn [2]

Mean Servicetime per Message



Mean Servicetime per Row



Conclusion

- Python Libraries a sophisticated enough for scaling real-time applications.
- Buffering incomming datarows can compensate overhead for Task Queues.
- $\frac{\lambda}{\mu} < c$ determine's the scaling for the application.
- All results are applicable to the machine learning process too.

Thank you for your attention!

This was

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