Algorithms Benchmarking Hackathon 1/2

PET++, CCP SyneRBI, CCP Tomographic Imaging

23-24 November 2021

Motivation

Variational framework for tomographic reconstruction :

$$\min_x \quad \underbrace{f(Ax)}_{\text{data fit}} + \underbrace{g(x)}_{\text{prior}}.$$

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In the last years, a plethora of algorithms have been developed to solve this equation:. . .

- convex optimization
- smooth optimization
- stochastic or deterministic

$\rightarrow$ how do they compare between each other?

Algorithms

Focus the benchmarking on stochastic algorithms:

- gradient-based algorithms (SAGA, SVREM)
- proximal-based algorithms (SPDHG).

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Hackathon 1/2 (now):

- Implement algorithms in CIL.
- Work on subset implementaton in CIL and STIR /SIRF.
- Use a CT reduced dataset.

Hackathon 2/2 (beginning of 2022):

- Benchmark on real PET and CT datasets in CIL and SIRF .

Goals of November hackathon

Goals:

- Implement gradient-based algorithms in CIL
  (SPDHG is already implemented)
- Implement subset data structure in STIR

What we need to decide on:

- versions of the algorithms to implement
- model (which prior: TV, regularized TV. . .)
- benchmarking measure (speed, memory usage. . .)

Timeline

Tuesday 23

14:00-16:00	Presentations
14:10	Gradient-based stochastic algorithms (Robbie Twyman, Zeljko Kereta, Junqi Tang)
15:40	CIL interface for subsets (Edoardo Pasca)
15:50	General overview of STIR subsets (Kris Thielemans)
16:10	Coffee break
16:30-18:00	Group work
19:30	Dinner in Abingdon (Mezze House)

Timeline

Wednesday 24

9:30	Progress report
9:40	Group work
11:00	Coffee break
12:20	Progress report
12:30	Lunch
13:30	Group work
15:00	Progress report + planning for the rest of the week
15:30	Coffee break
16:00	End of in-person event

Organizers

Thanks to all the organizers!

Claire Delplancke, Matthias Ehrhardt, Ashley Gillman, Evangelos Papoutsellis, Edoardo Pasca , Junqi Tang, Kris Thielemans.