Real-time Large-Scale Dense 3D Reconstruction with Loop Closure

Aim: track and reconstruct large spaces densely
Problem: tracking drifts – errors on loop closure
- Recognise previously visited locations
- Globally adjust previous estimations
For online dense SLAM this is impractical
- Adjusting large scenes becomes slow
- Existing solutions require offline post-processing

Scene represented by collection of submaps
Use volumetric fusion for each submap independently
Relative constraints between submaps gathered online
On loop closure, adjust graph of submaps
→ Overall processing takes milliseconds per frame

Key idea: Maintain list of several active submaps:
- Start with standard fusion pipeline for a single submap
- Once initial part is out of view, start new submap
- Track both submaps simultaneously and accumulate relative constraints
- Once relocaliser detects loop closure, start new standard tracking pipeline
- Run graph optimisation with accumulated constraints
- Visualisation: On-the-fly fusion of all submaps

Processing time:
- 7.1 – 8.5 ms per frame
- Remains constant