Stereo SLAM
(Simultaneous localization and Mapping)

Group: A-Team

- Goal: accurate dense point cloud representation of the world

Step 1

- Grid-FAST Detector
- User specified
  - grid size
  - points per cell
- Decrease Workload for Descriptor

Step 2 - 3D Feature Map of the environment

- Not only current time step t[n] and last timestamp t[n-1]
- All previous time steps t up to now
- Compare currently detected 3D features (Point3d + keypoints + descriptors) with all previous ones
  - computationally expensive
  - many past points are not visible
- New data structure: Keyframe

Step 3 - dense map

- At this stage resulting map very sparse
  - Represented as point cloud
- Use dense point cloud at every Keyframe (exercise 4)
  - Integrate rebuilding dense point clouds into the map
  - Result: dense map
- Dense stereo reconstruction
  - Run in a separate thread for each new Keyframe

Step 4 (optional)

- Improve performance via
  - Sliding Window optimization
  - Bundle adjustment
- Several opportunities are included in OpenSLAM and g2o

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- Keyframe
  - Aggregate 3D features from multiple views
  - Stores transformation
    - world to current Keyframe K_c
- Match currently detected 3D features
- only against closest Keyframe K_c

- New Keyframe
  - Ratio: detected points with / without matches
  - After certain distance (e.g. 1m)
  - Every x frames
  - All points from last Keyframe visible at the current position
  - Set new Keyframe transformation

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