Compressed Sensing on Multi-pinhole Collimator SPECT Camera for Sentinel Lymph Node Biopsy

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**Motivation**

Standard procedure for cancer in the head and neck includes a complete surgical removal of the lymph nodes, which is needed in less than 30% of the cases. Finding the exact position of the sentinel lymph nodes will be helpful for less invasive surgical biopsy and exclude regional spread of the cancer.

**Material**

Using a multi-pinhole collimator [1] to reconstruct the activity map of the radioactive tracer, using a single image of the detector.

- Detector’s resolution is $487 \times 195$ pixels of the size $172 \mu m \times 172 \mu m$
- Collimator: Tungsten, $86.9 \text{mm} \times 36 \text{mm} \times 36 \text{mm}$, 24 pinhole compartments

**Image Processing**

Detector’s image is not sparse:

- Solving linear system would take long & be inaccurate
- Difficult to use geometric properties of the collimator

$\Rightarrow$ Use a pipeline of image processing to get sparsity

**Methods**

**Inverse Problem** Let $A$ be an linear operator, which projects an activity map $v$ on the detector $d$ such that $A v = d$.

For a given detector image $d^{\text{true}}$ we solve:

$$\min_v ||v||_1 \text{ s.t. } ||A v - d^{\text{true}}||_2 \leq \epsilon$$

using WSPGL1. [4]

**Results**

Visualization of our experiment with one source:

Visualization of our experiment with two sources:

Visualization of our experiment with three sources:

**References**