Image Analysis and Computer Vision 2021/2022

Semantic Sampling Localization: RGB-D Patch-Based Triplet Network

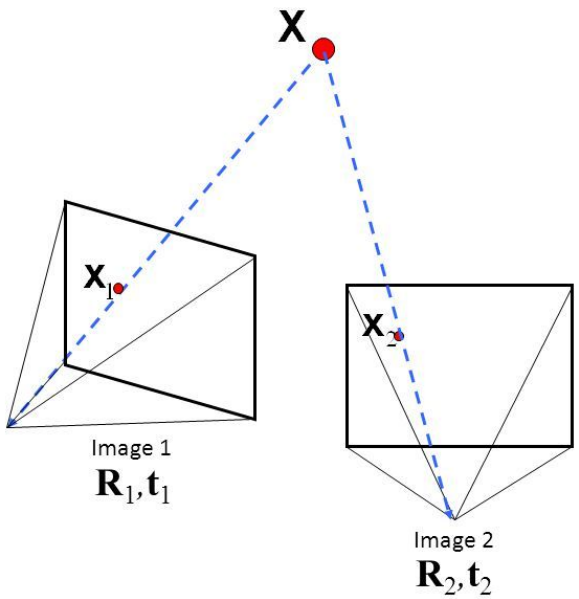
Marco **Petri** 10569751
Mirko **Usuelli** 10570238

Professor: Vincenzo Caglioti
Advisors: Giacomo Boracchi, Luca Magri, Antonino Maria Rizzo

LOCALIZATION

Localization

Epipolar Geometry

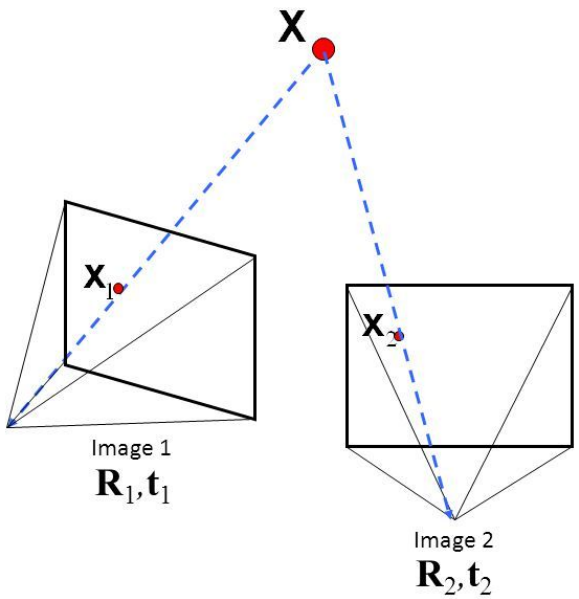


$$\mathbf{x}_1 \leftrightarrow \mathbf{x}_2$$

$$\mathbf{x}_1^T \mathbf{F} \mathbf{x}_2 = 0$$

Localization

Epipolar Geometry

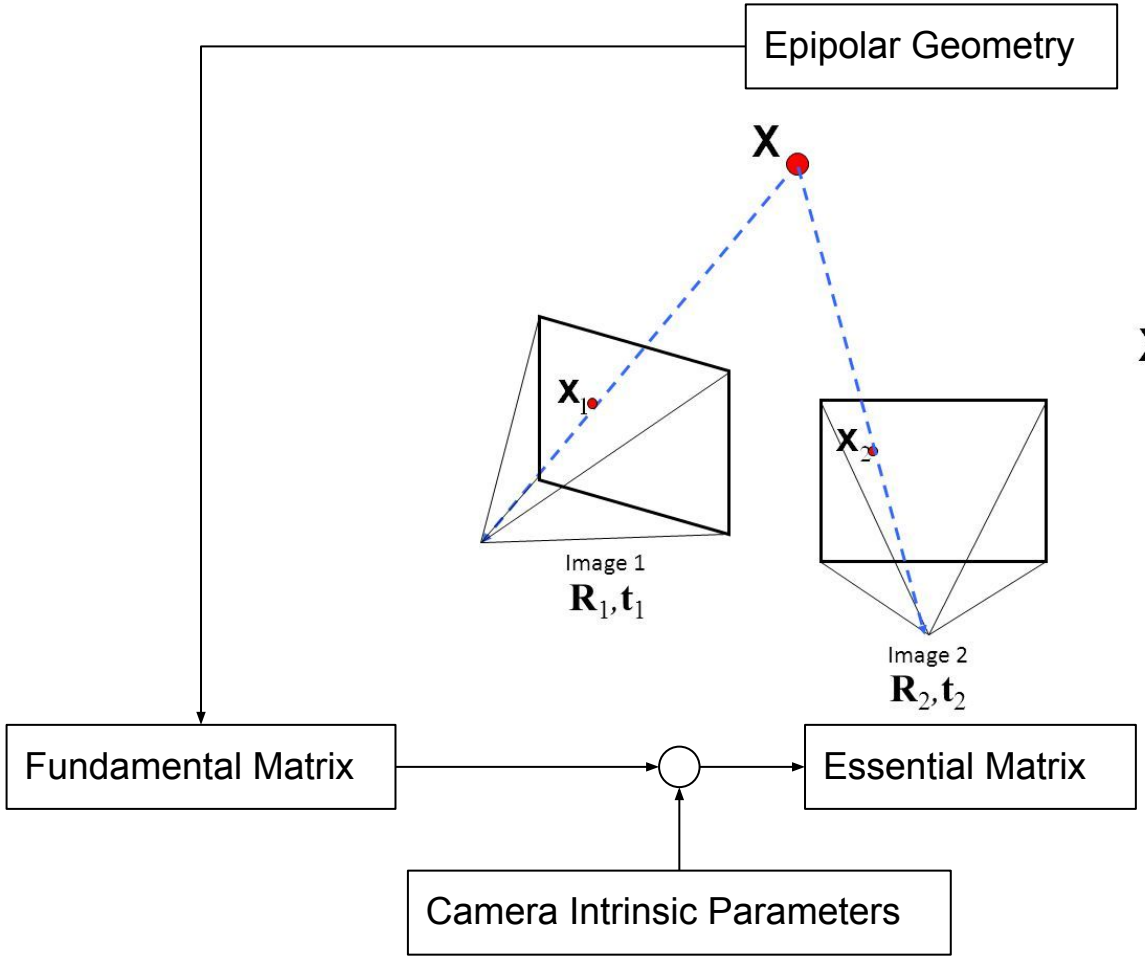


$$\mathbf{x}_1 \leftrightarrow \mathbf{x}_2$$

$$\mathbf{x}_1^T \mathbf{F} \mathbf{x}_2 = 0$$

Fundamental Matrix

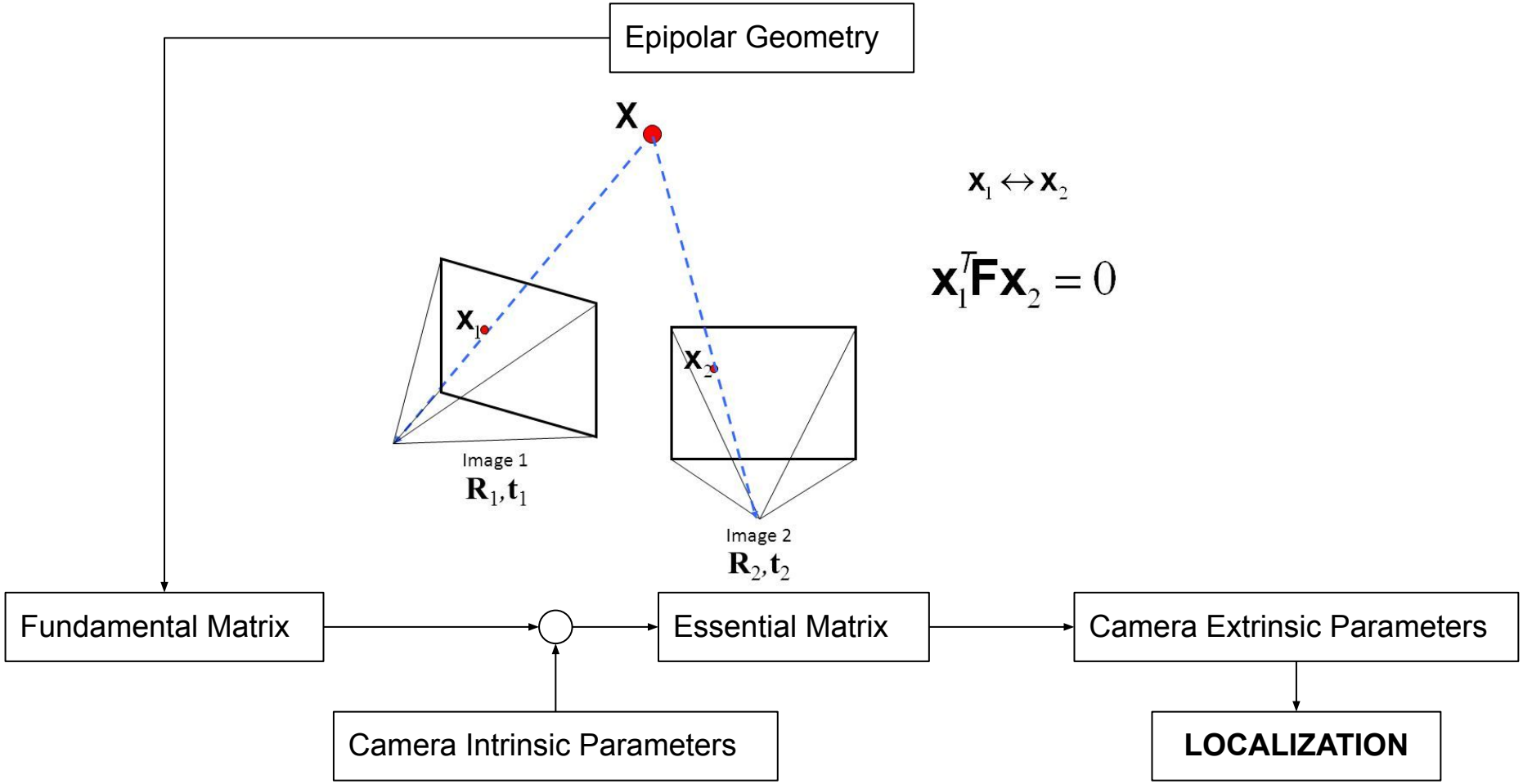
Localization



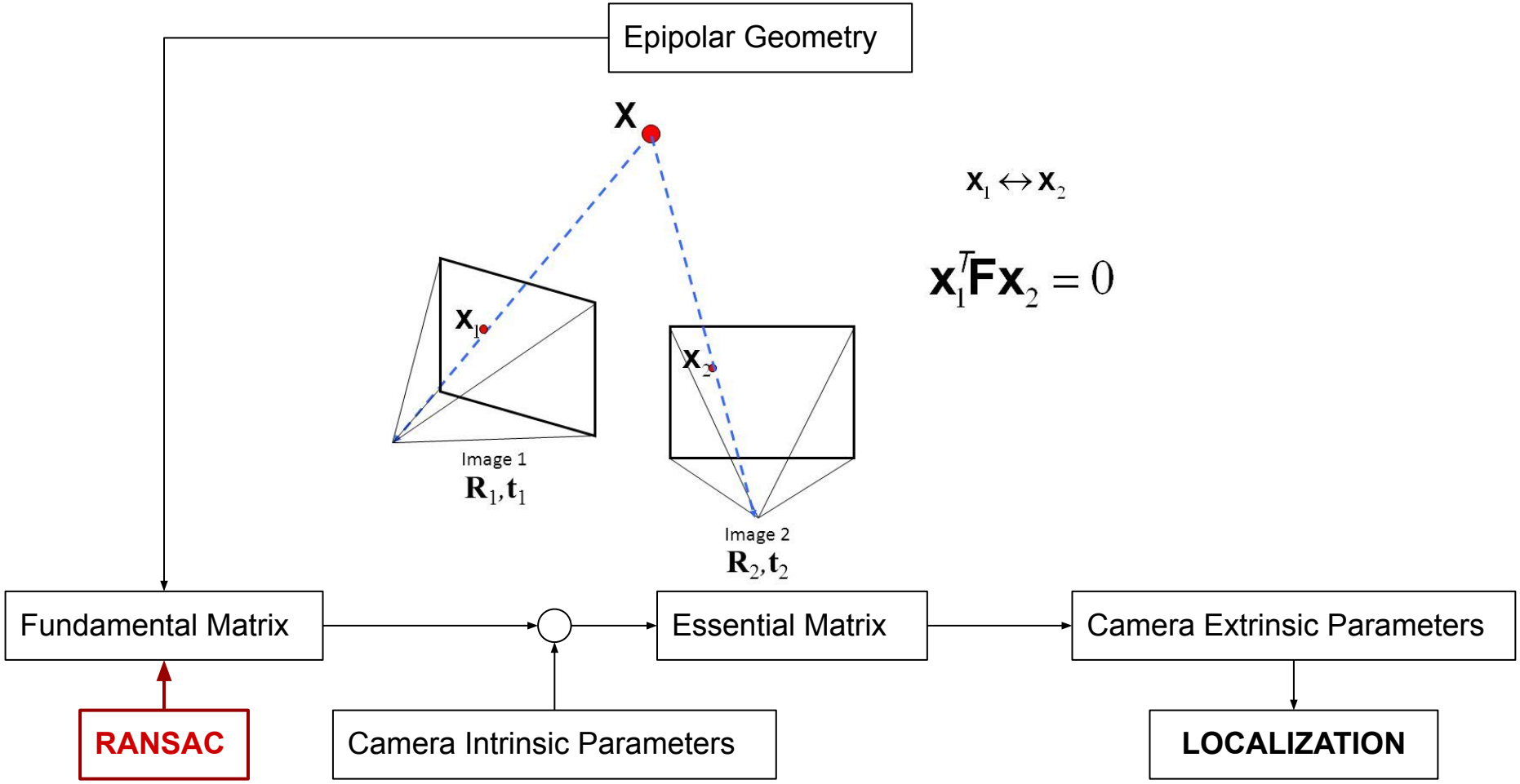
$$\mathbf{x}_1 \leftrightarrow \mathbf{x}_2$$

$$\mathbf{x}_1^T \mathbf{F} \mathbf{x}_2 = 0$$

Localization

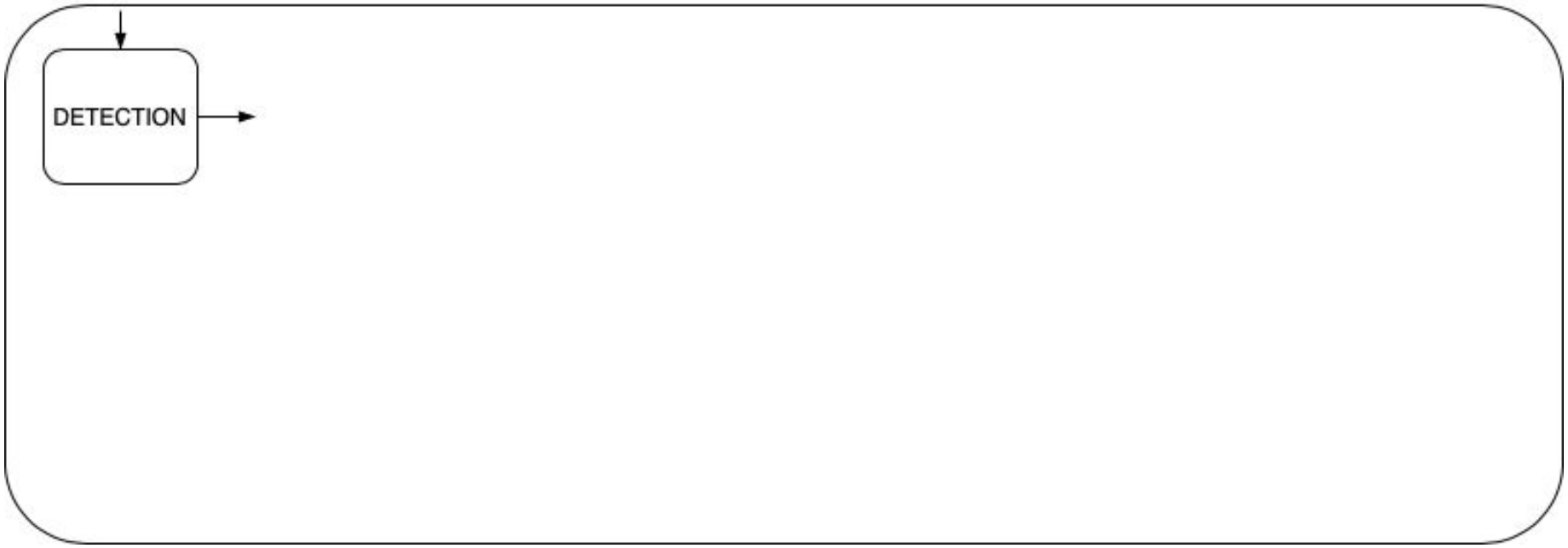


Localization

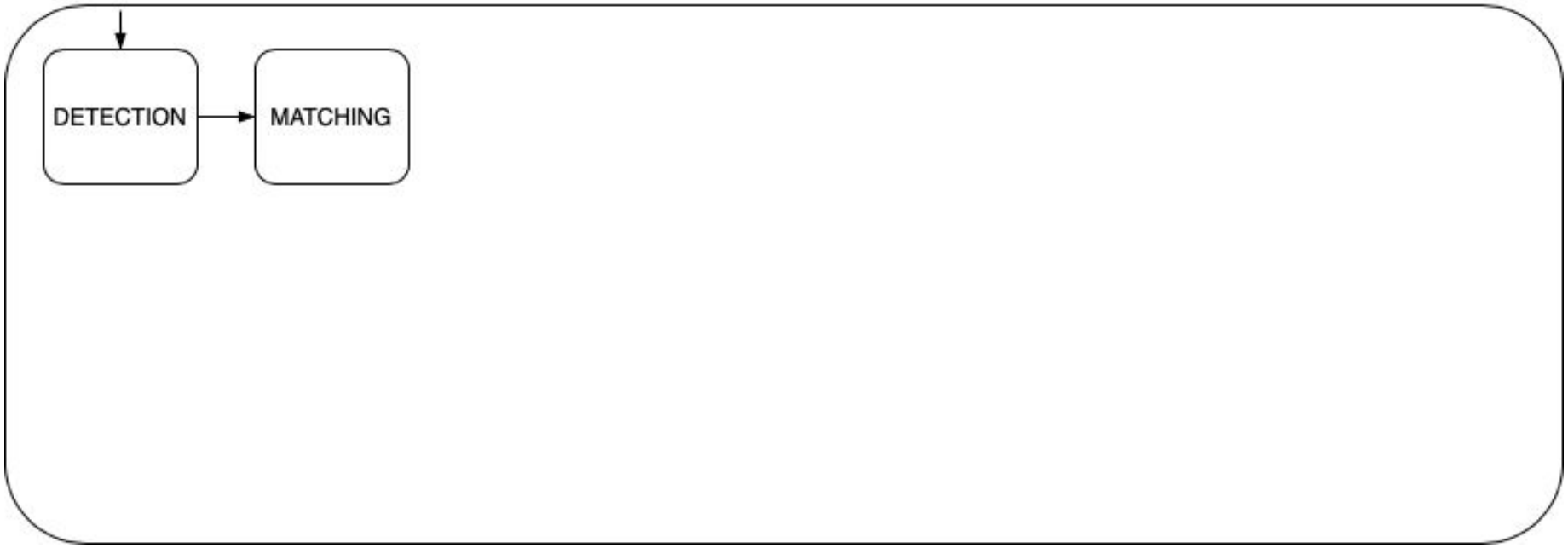


WORKFLOW

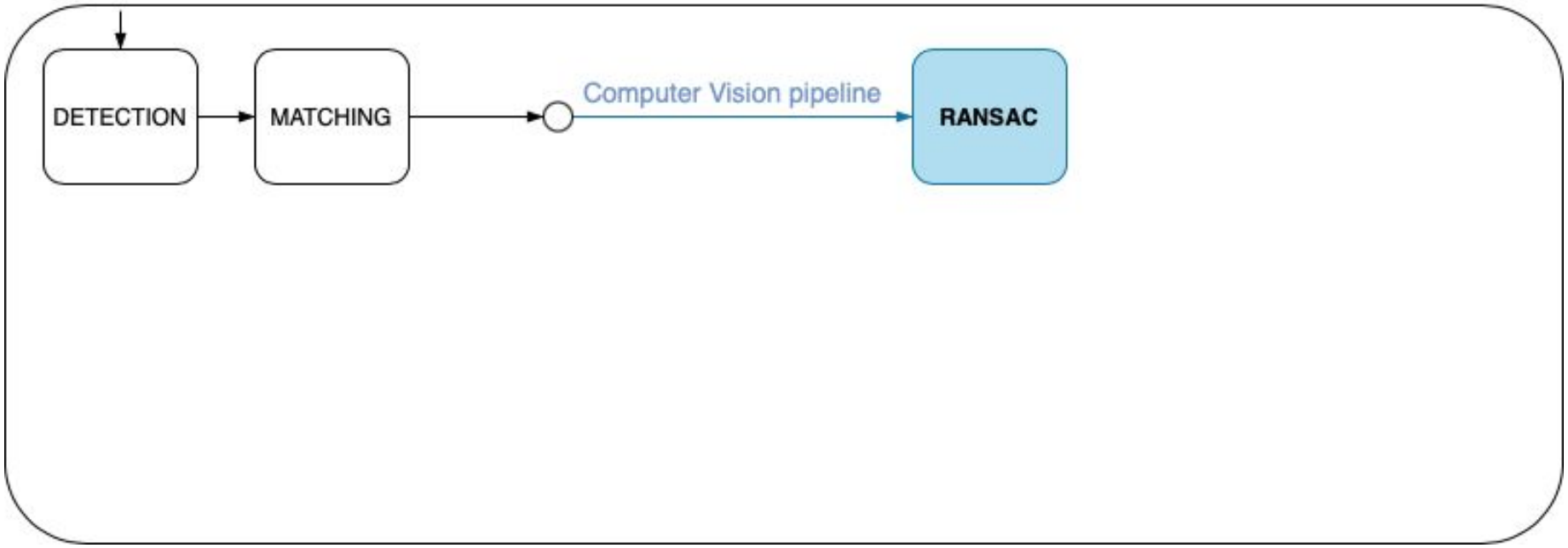
Workflow



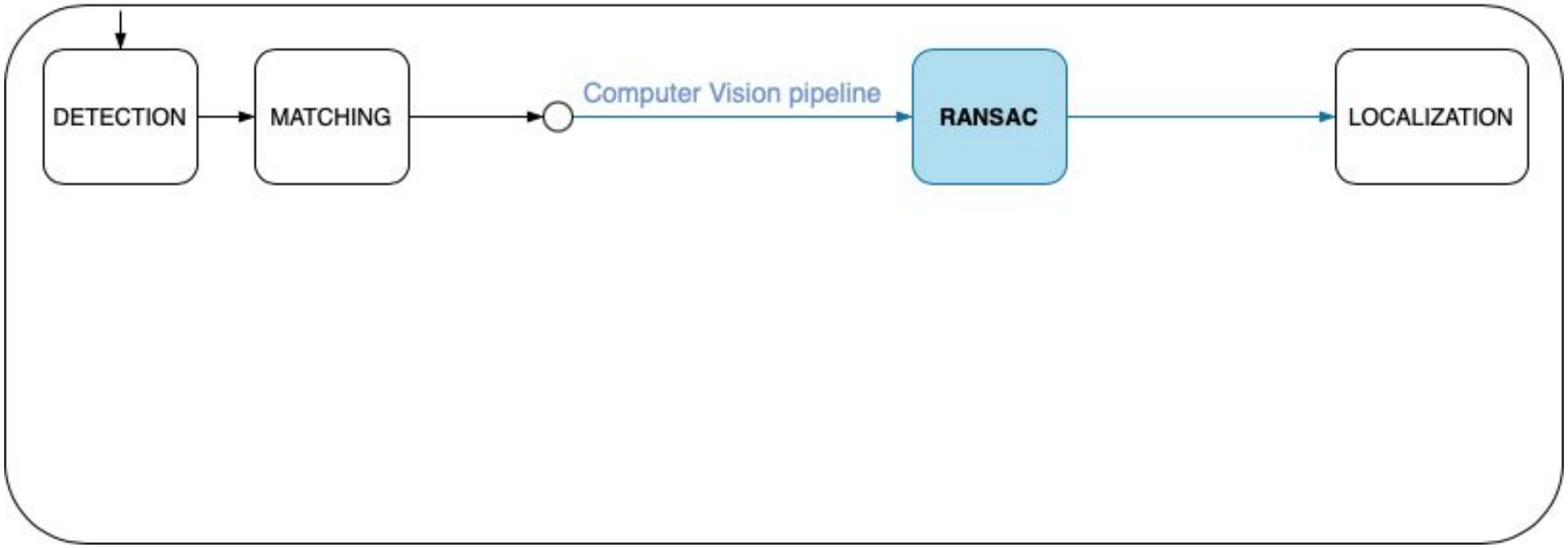
Workflow



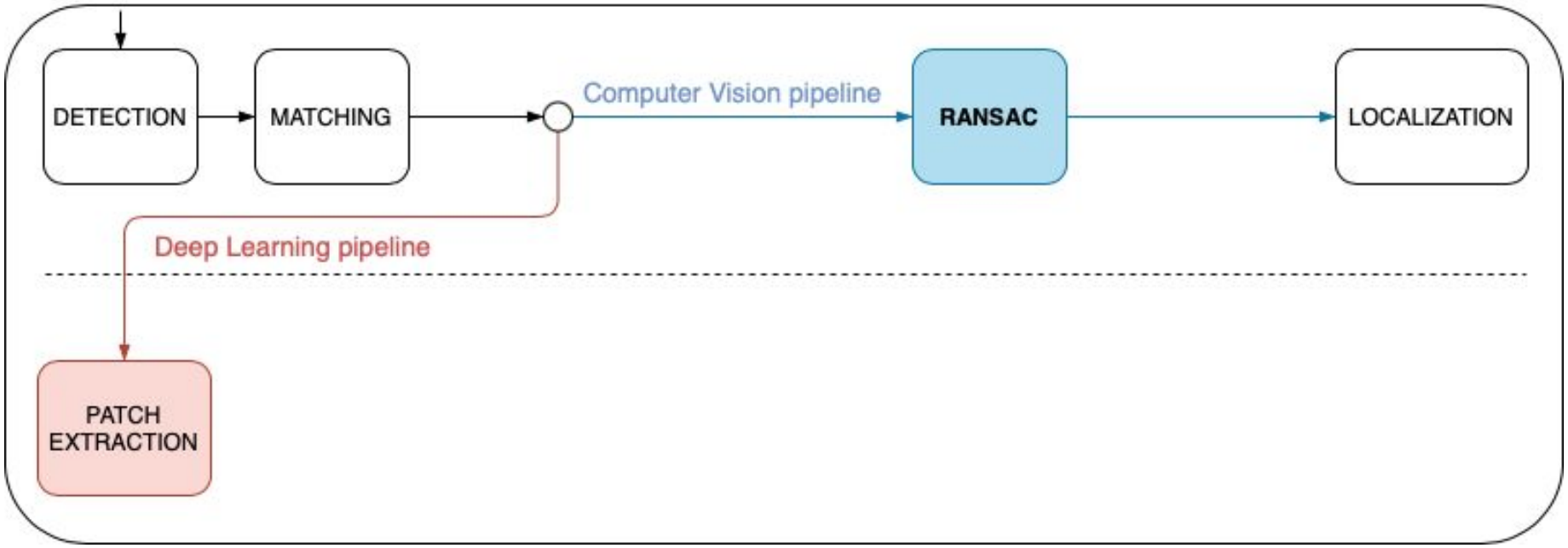
Workflow



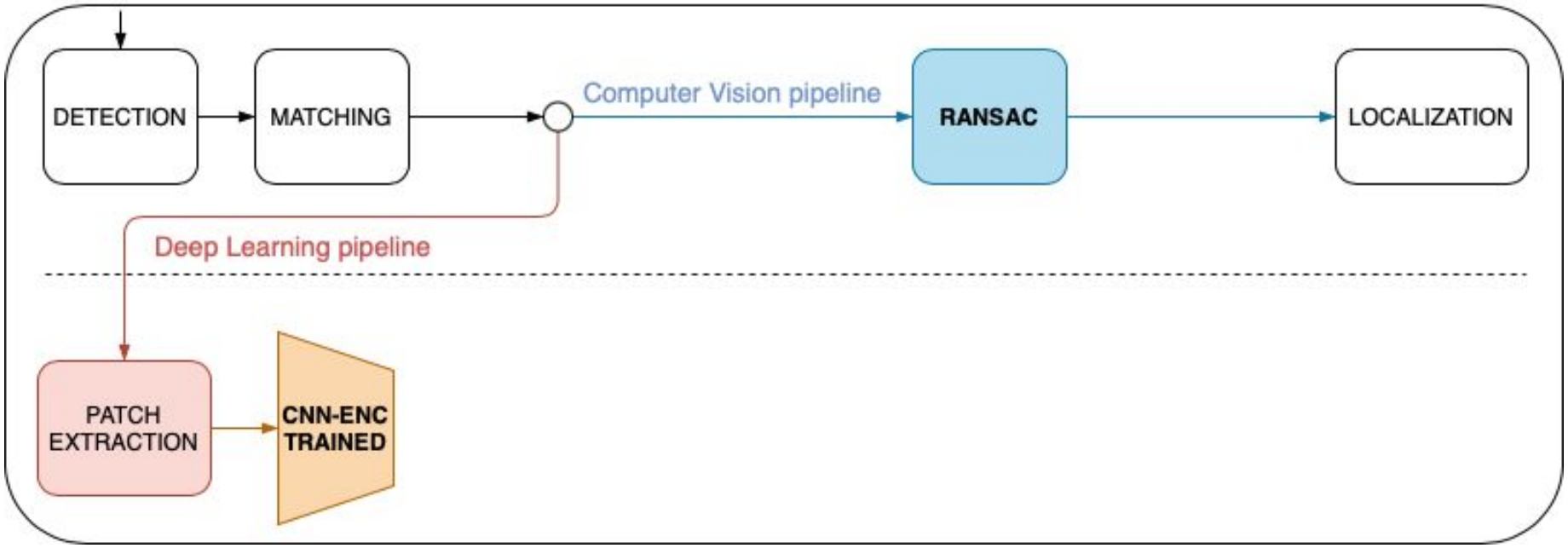
Workflow


DETECTION
MATCHING
Computer Vision pipeline
RANSAC
LOCALIZATION

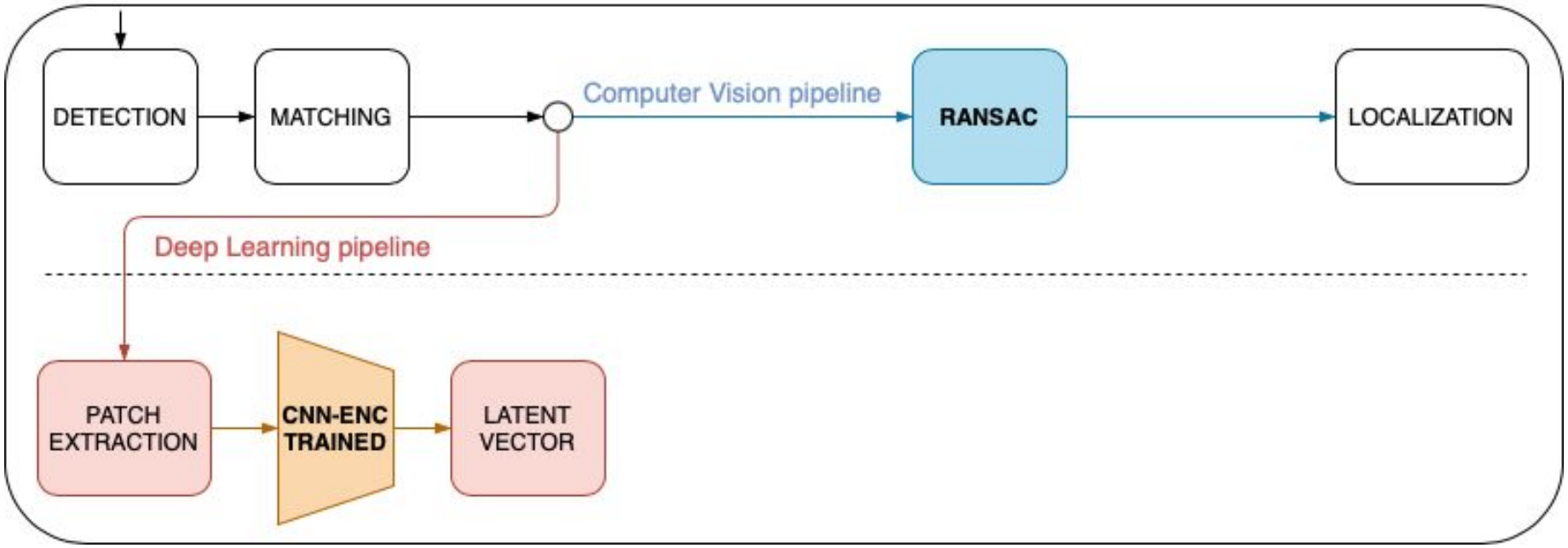
Workflow


DETECTION
MATCHING
Computer Vision pipeline
RANSAC
LOCALIZATION
Deep Learning pipeline
PATCH EXTRACTION

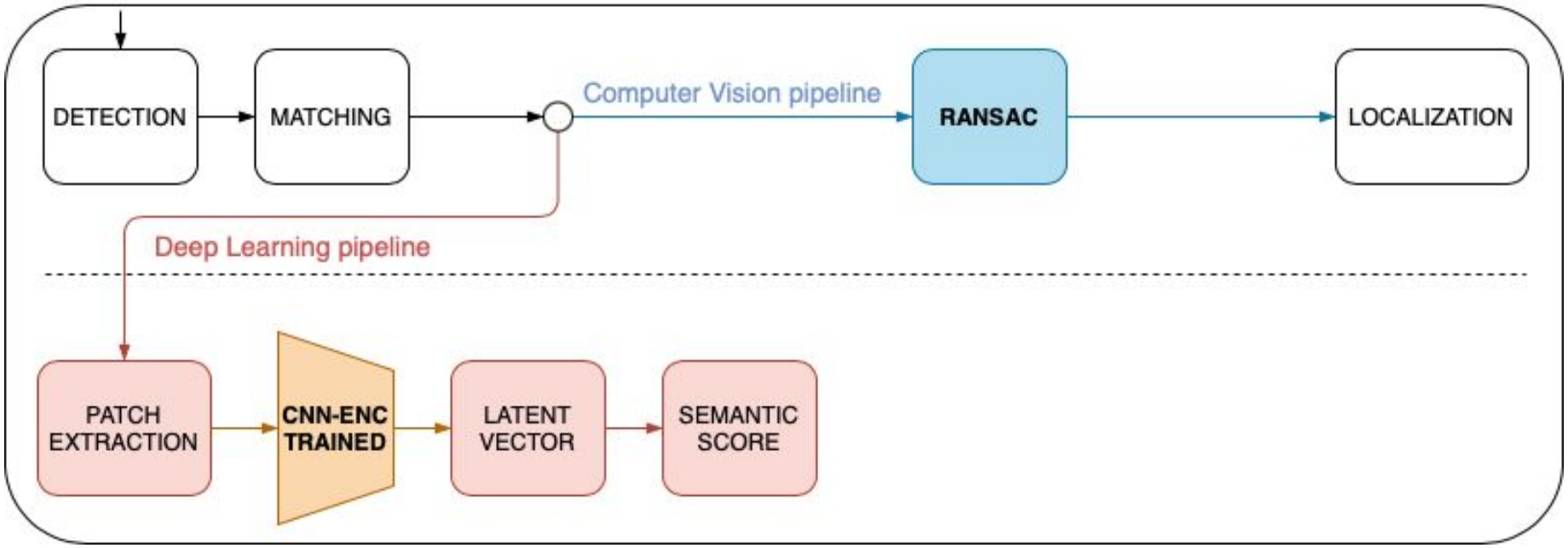
Workflow


DETECTION
MATCHING
Computer Vision pipeline
RANSAC
LOCALIZATION
Deep Learning pipeline
PATCH EXTRACTION
CNN-ENC TRAINED

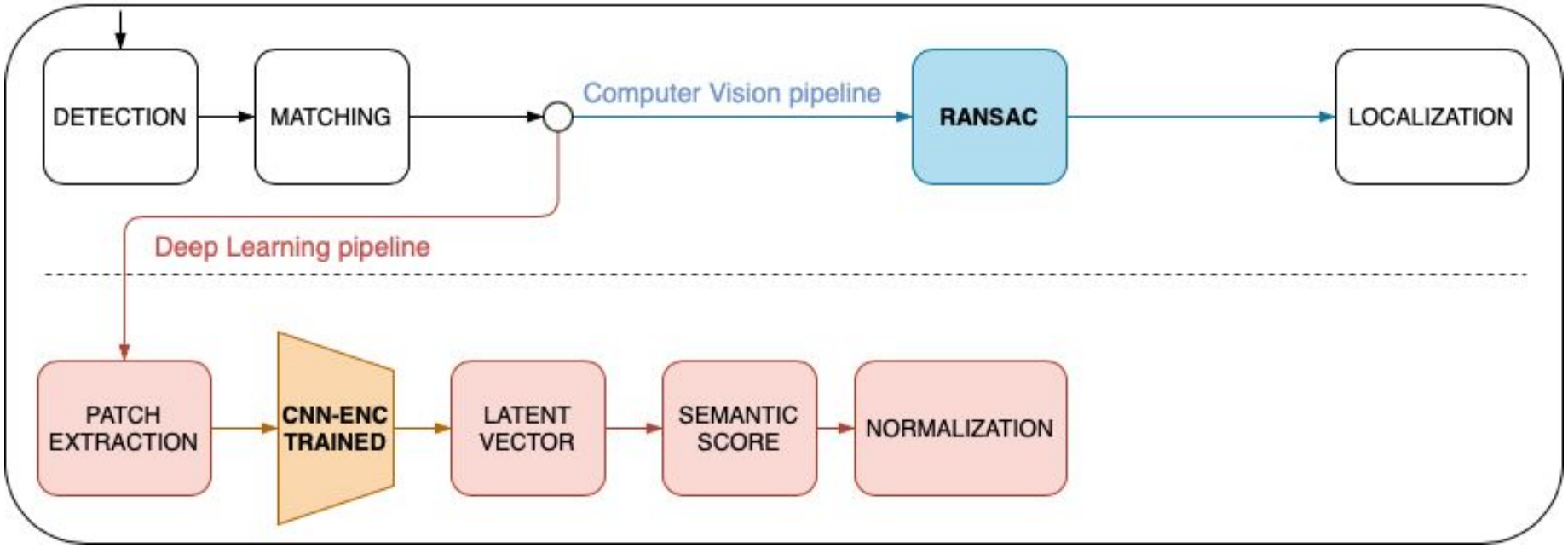
Workflow


DETECTION
MATCHING
Computer Vision pipeline
RANSAC
LOCALIZATION
Deep Learning pipeline
PATCH EXTRACTION
CNN-ENC TRAINED
LATENT VECTOR

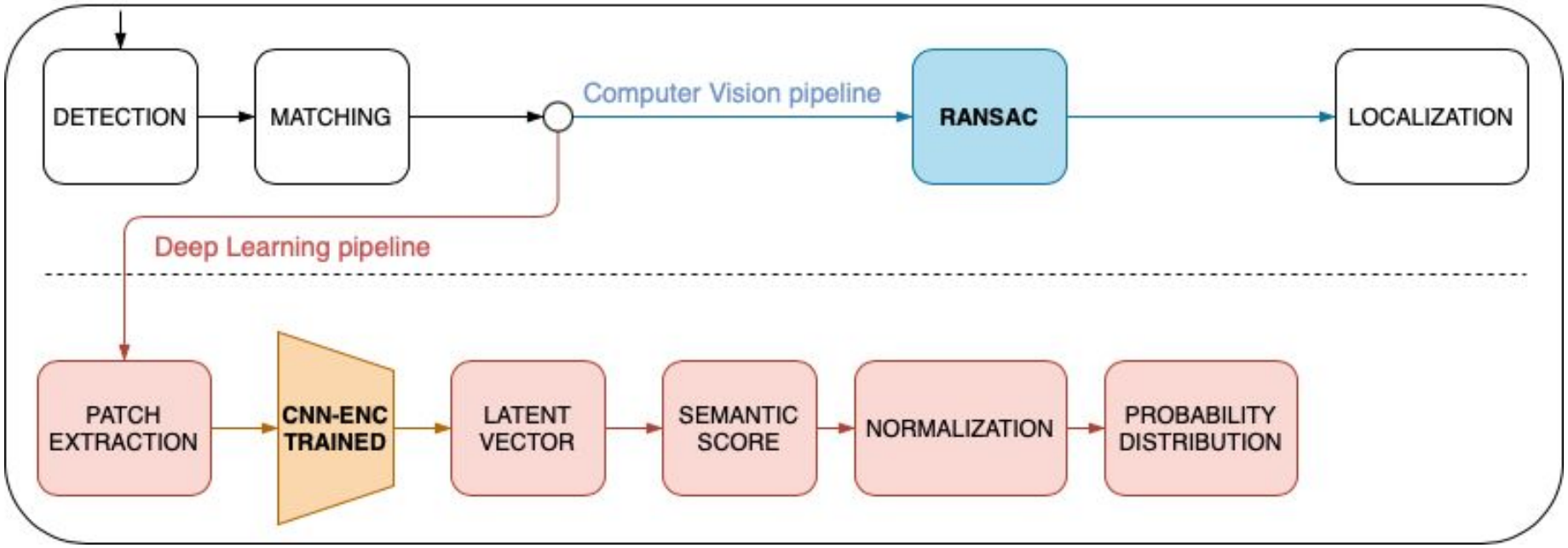
Workflow


DETECTION
MATCHING
Computer Vision pipeline
RANSAC
LOCALIZATION
Deep Learning pipeline
PATCH EXTRACTION
CNN-ENC TRAINED
LATENT VECTOR
SEMANTIC SCORE

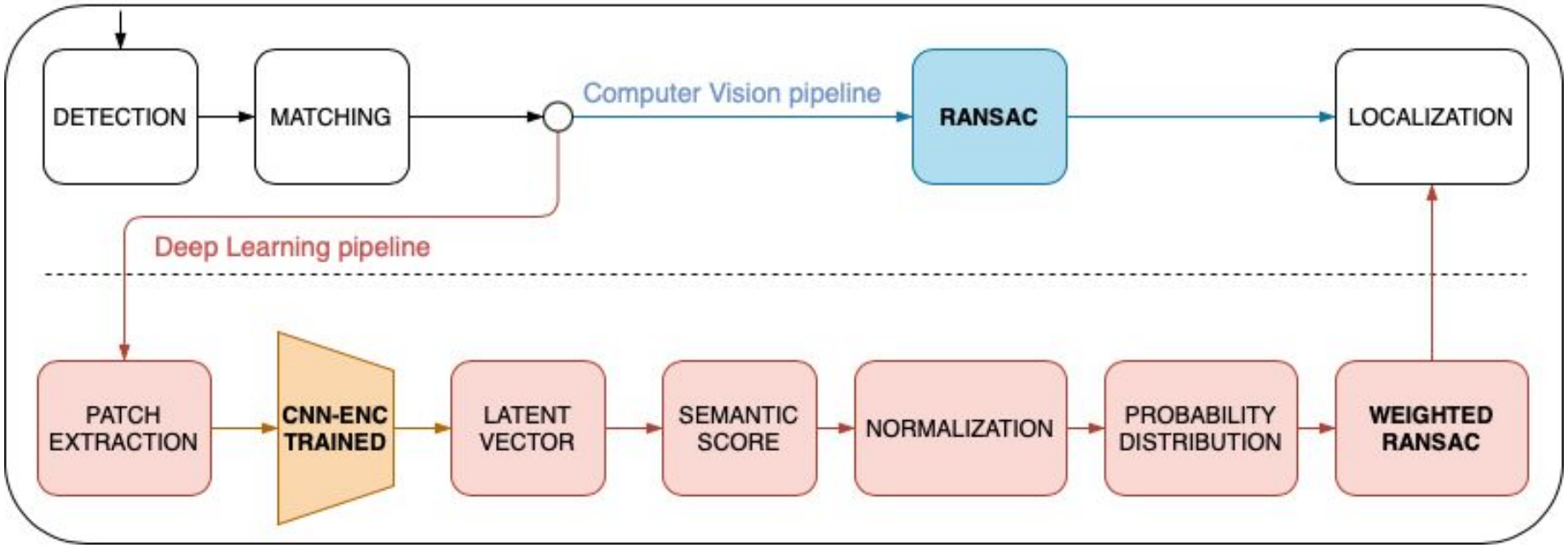
Workflow


DETECTION
MATCHING
Computer Vision pipeline
RANSAC
LOCALIZATION
Deep Learning pipeline
PATCH EXTRACTION
CNN-ENC TRAINED
LATENT VECTOR
SEMANTIC SCORE
NORMALIZATION

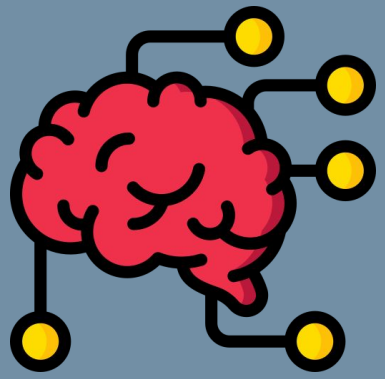
Workflow


DETECTION
MATCHING
Computer Vision pipeline
RANSAC
LOCALIZATION
Deep Learning pipeline
PATCH EXTRACTION
CNN-ENC TRAINED
LATENT VECTOR
SEMANTIC SCORE
NORMALIZATION
PROBABILITY DISTRIBUTION

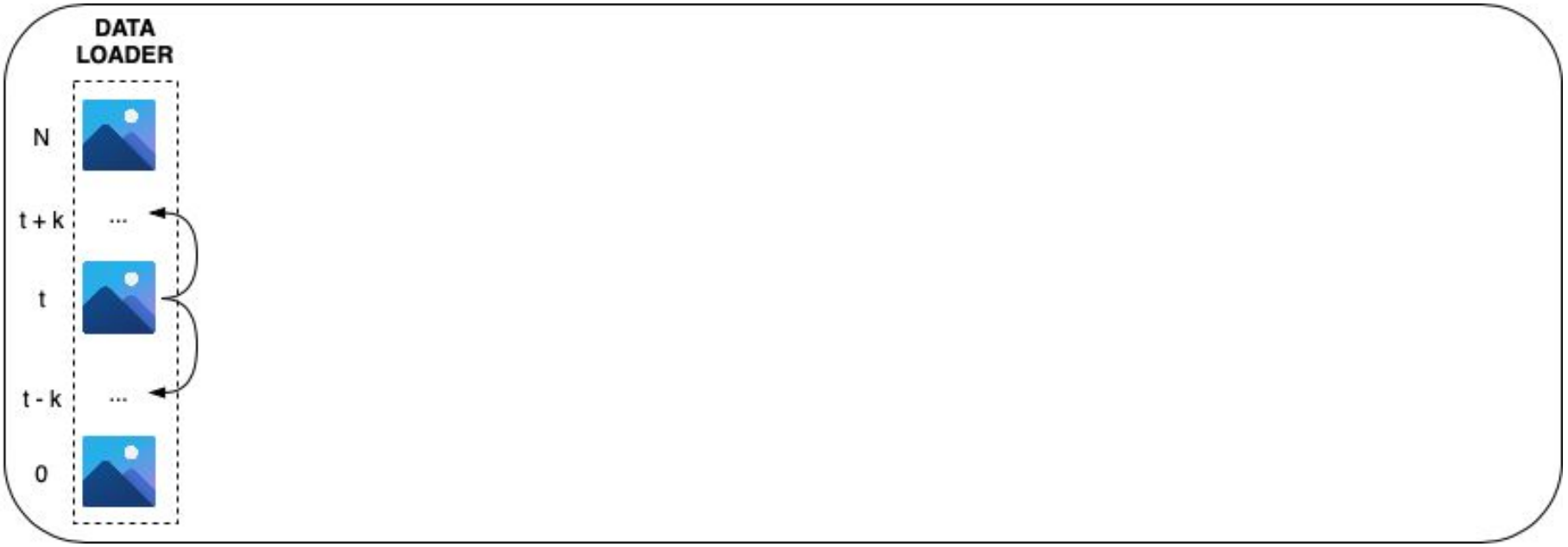
Workflow


DETECTION
MATCHING
Computer Vision pipeline
RANSAC
LOCALIZATION
Deep Learning pipeline
PATCH EXTRACTION
CNN-ENC TRAINED
LATENT VECTOR
SEMANTIC SCORE
NORMALIZATION
PROBABILITY DISTRIBUTION
WEIGHTED RANSAC

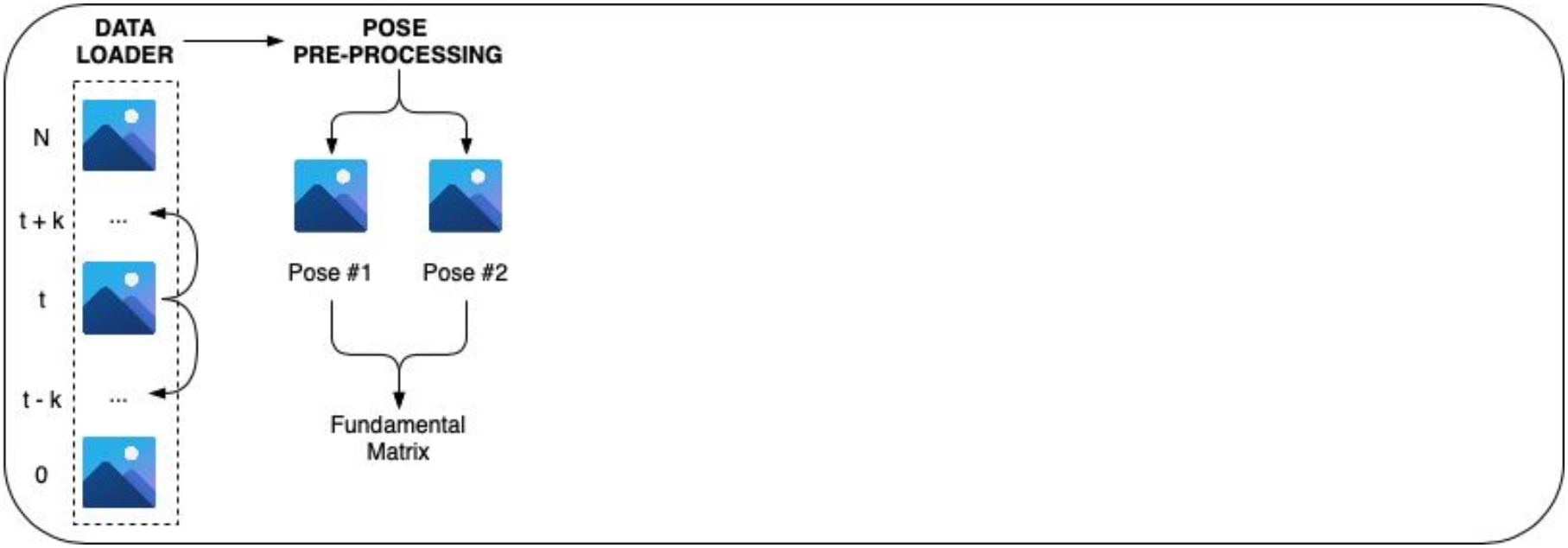
TRIPLET NETWORK



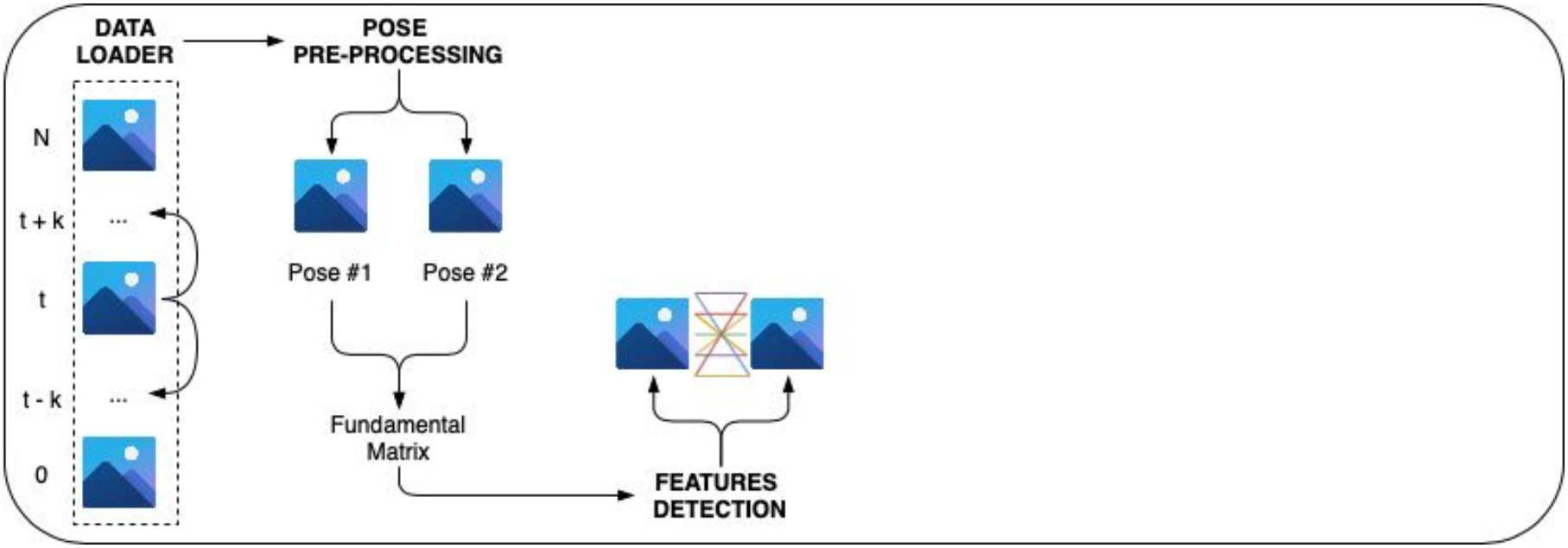
Triplet Network Training



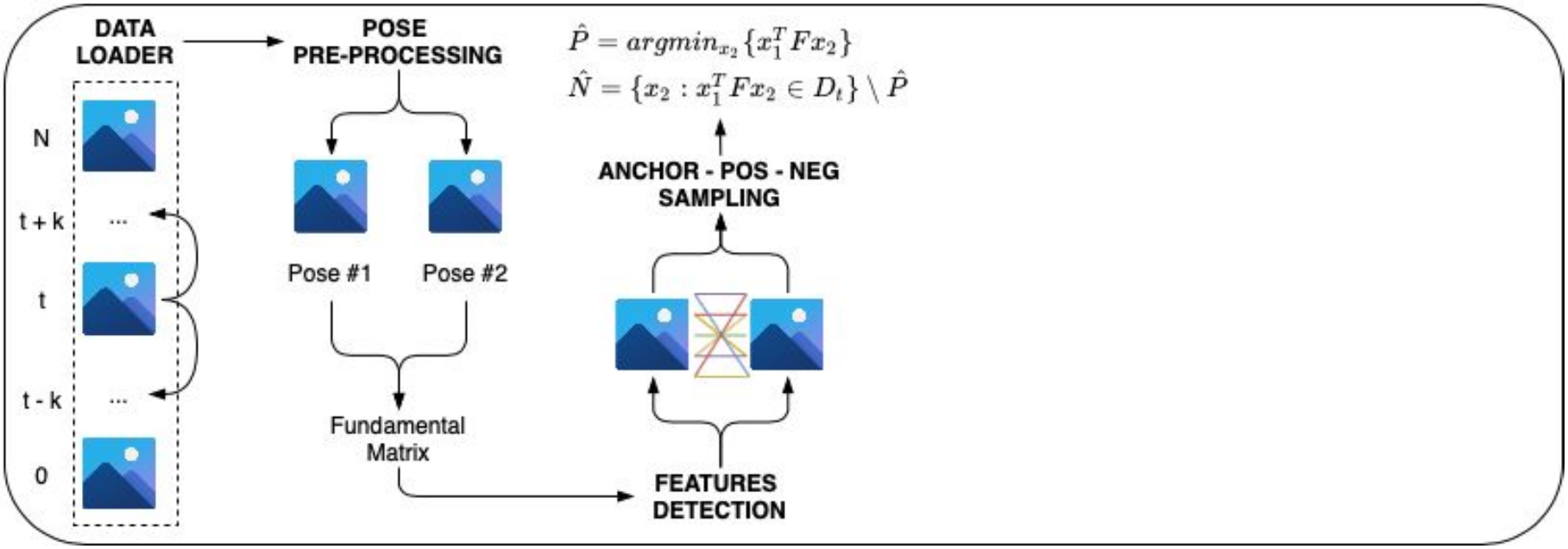
Triplet Network Training



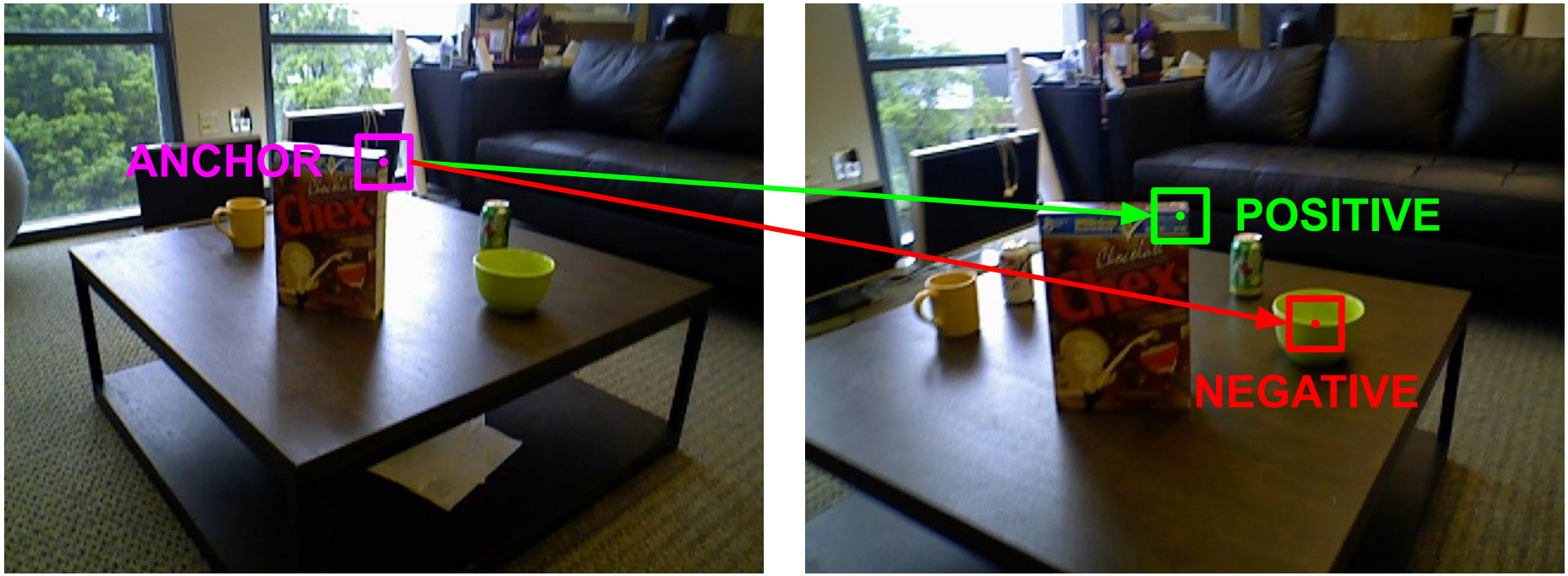
Triplet Network Training



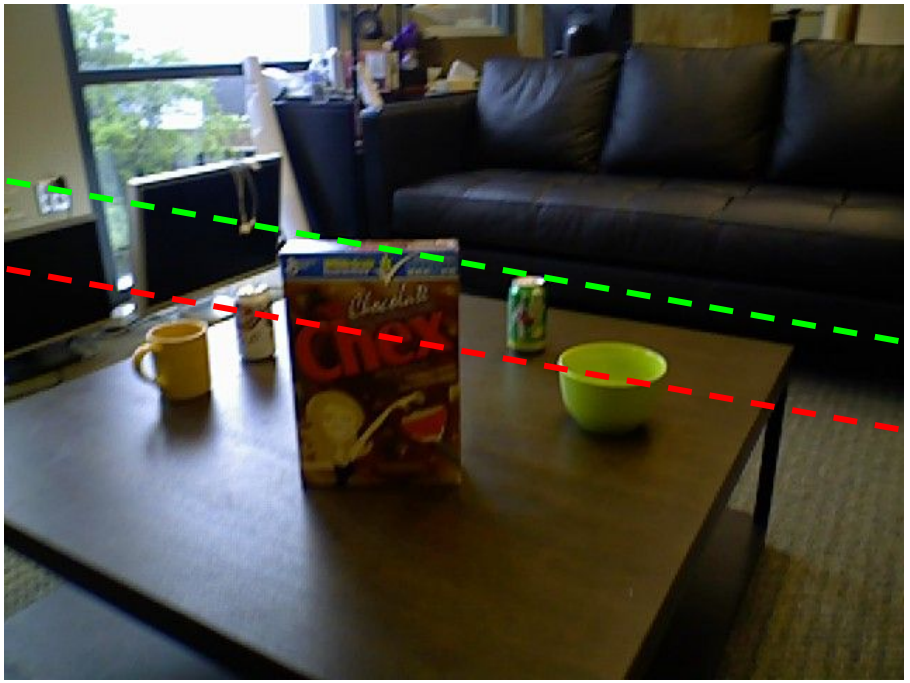
Triplet Network Training



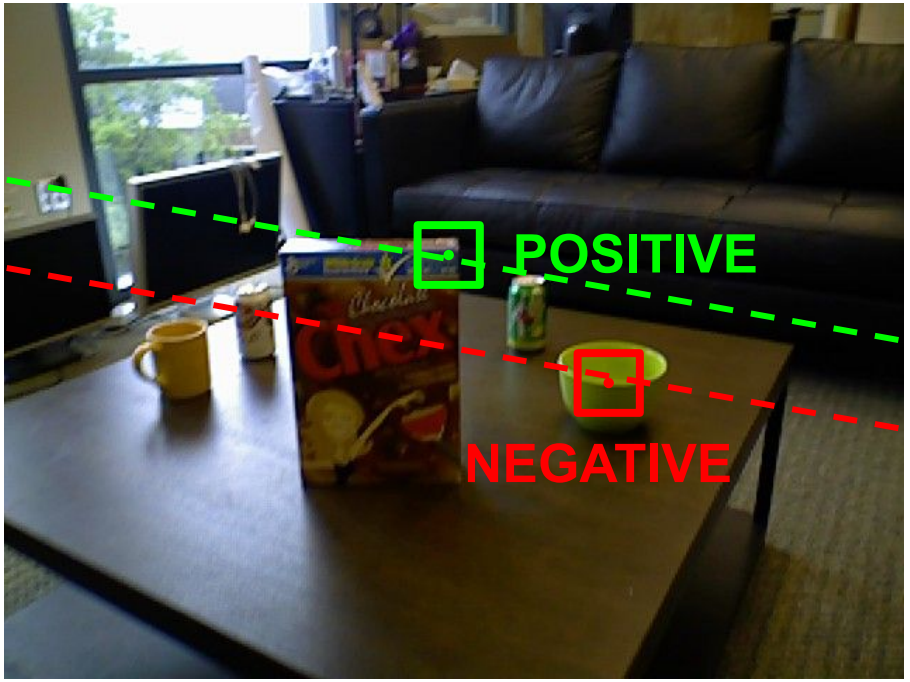
Anchor - Positive - Negative



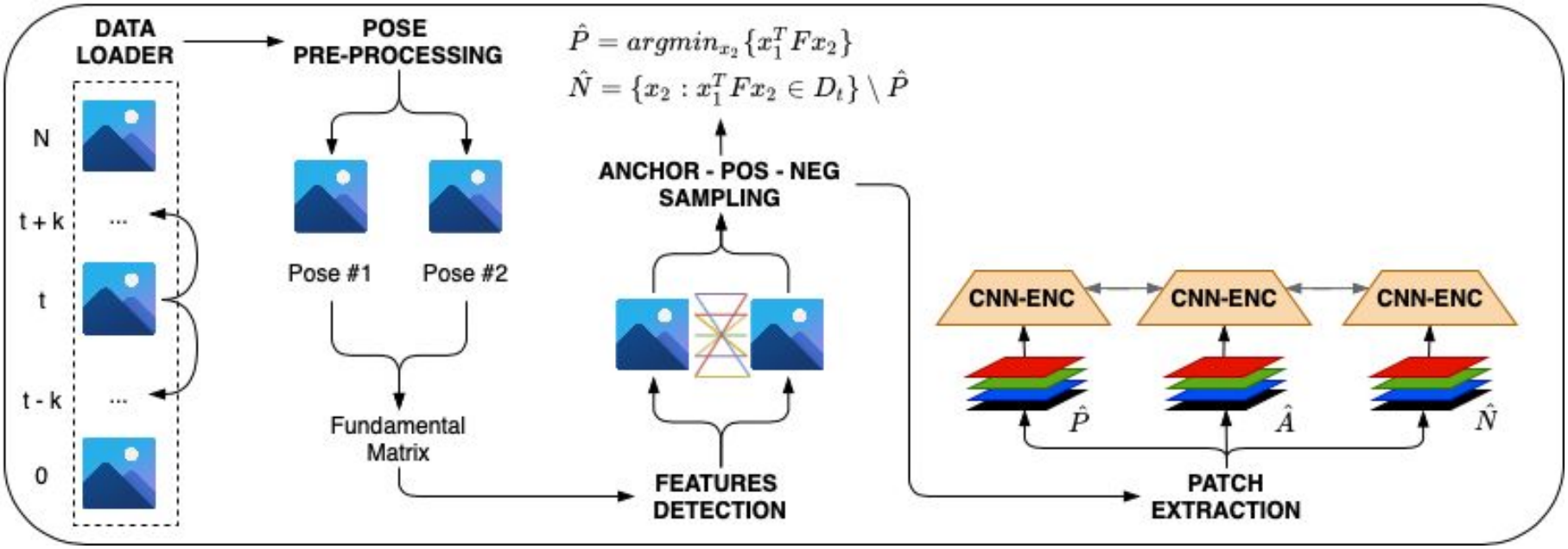
Anchor - Positive - Negative



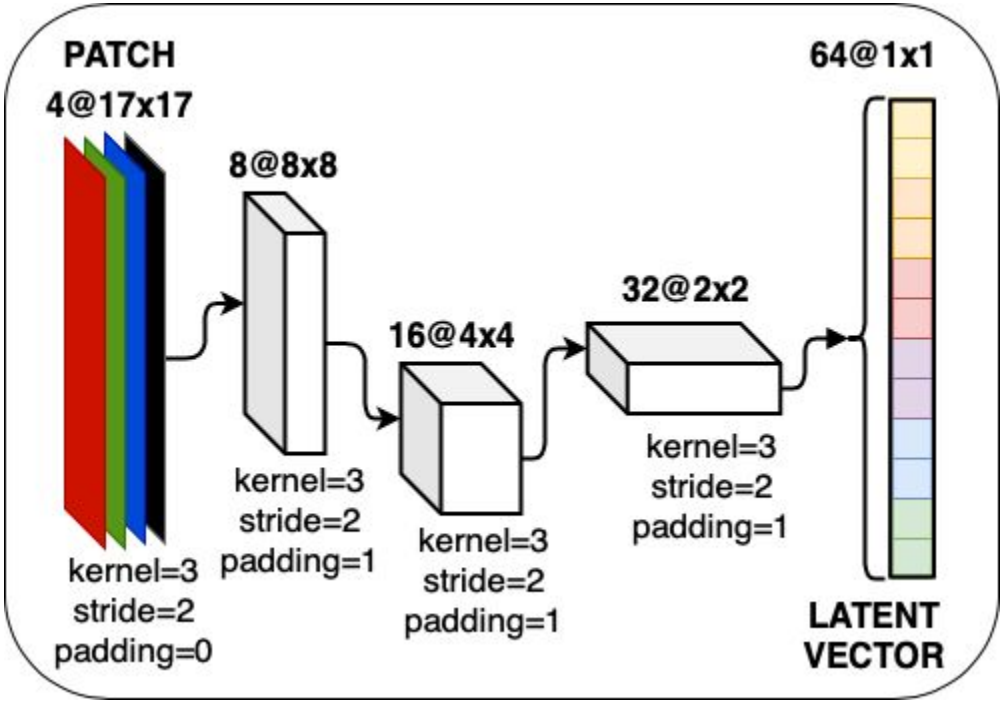
Anchor - Positive - Negative



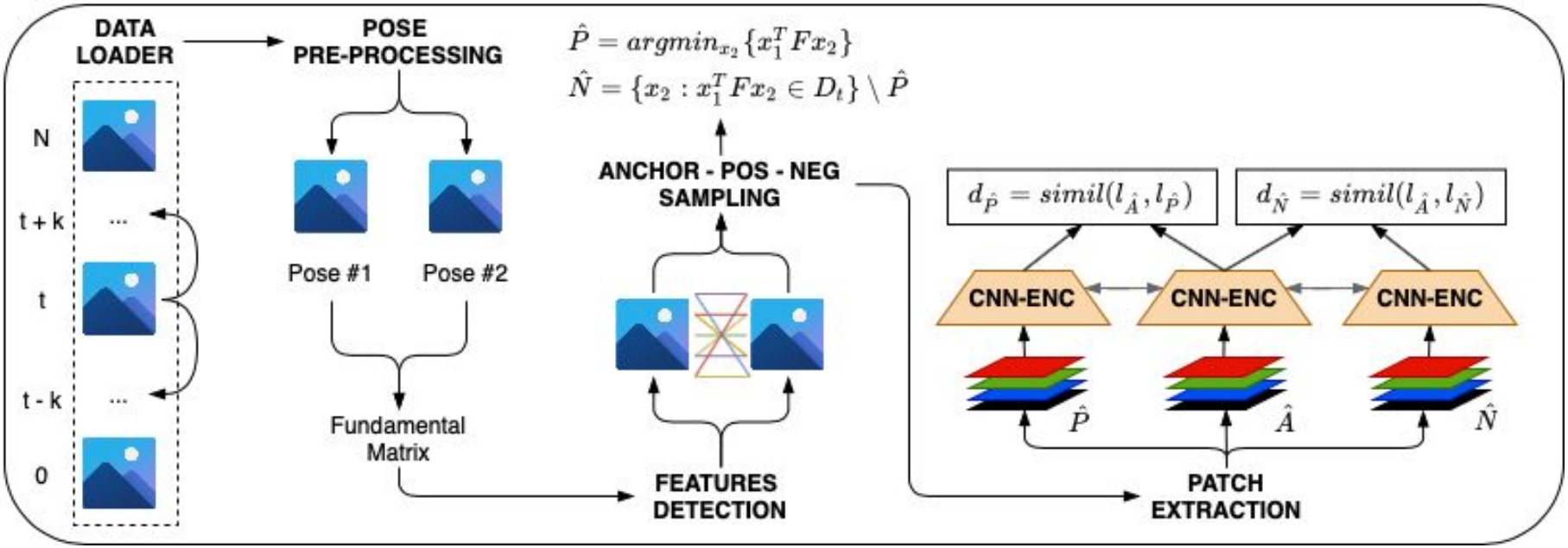
Triplet Network Training



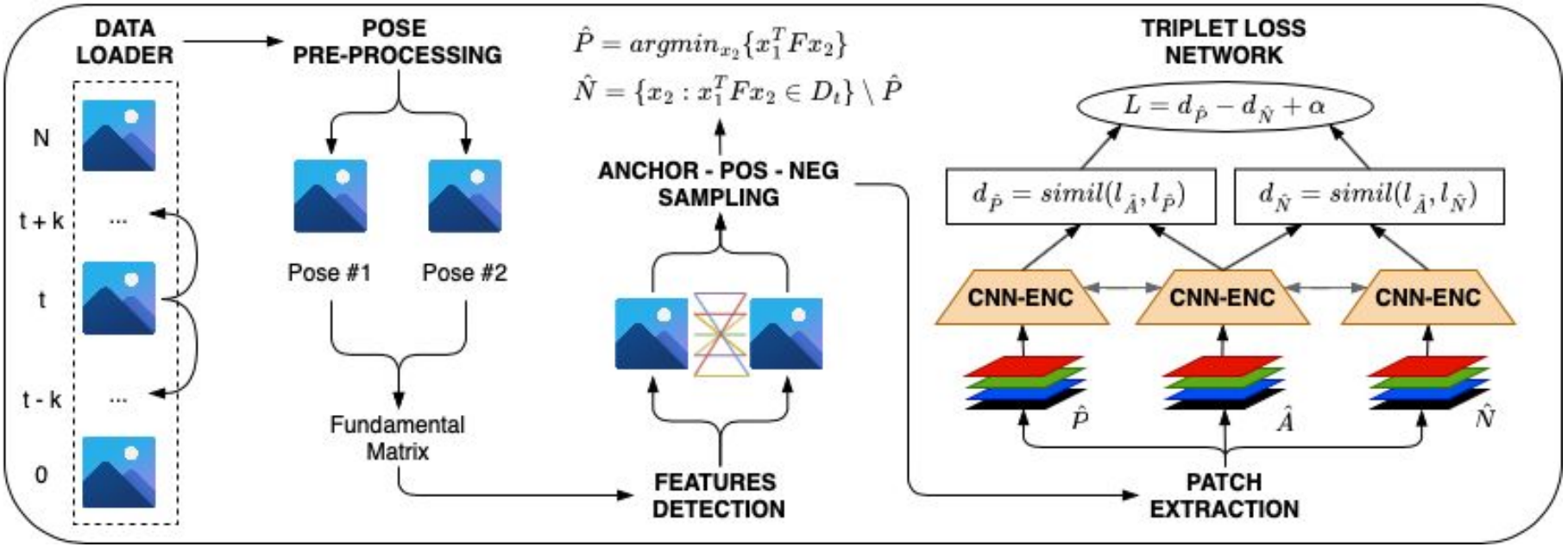
Encoder


PATCH
4@17x17
kernel=3
stride=2
padding=0
8@8x8
kernel=3
stride=2
padding=1
16@4x4
kernel=3
stride=2
padding=1
32@2x2
kernel=3
stride=2
padding=1
64@1x1
LATENT
VECTOR

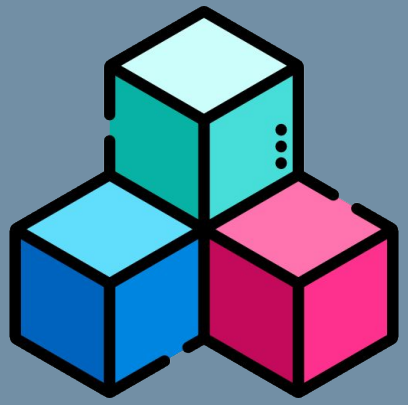
Triplet Network Training



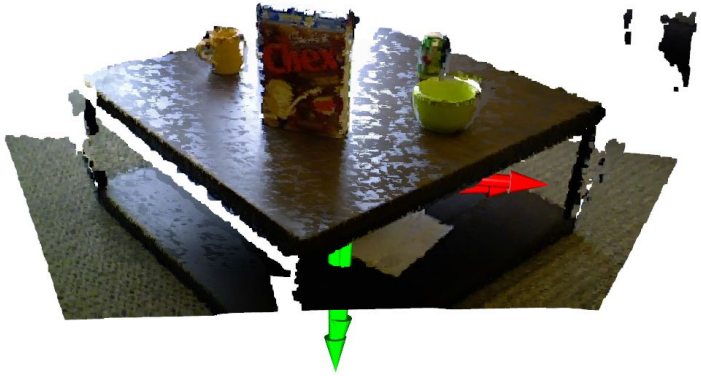
Triplet Network Training



POINT CLOUD

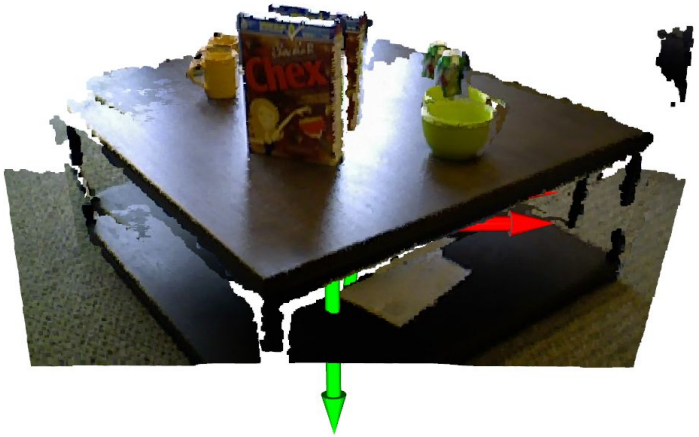


Point clouds of images distant by 50 steps

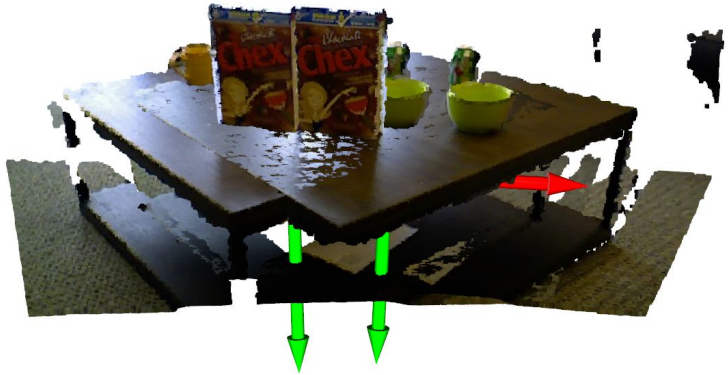


ICP

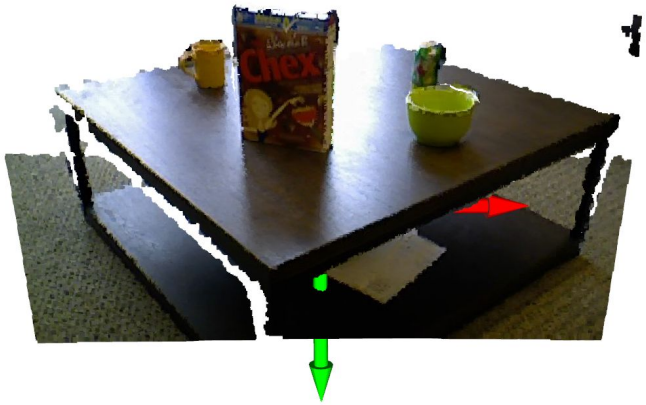
POSE



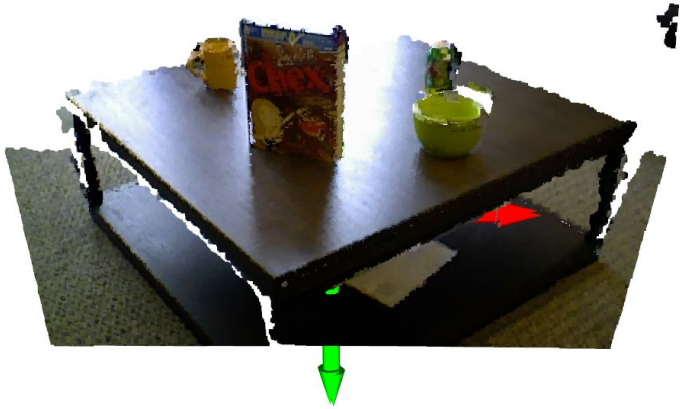
RGB 3D



Point clouds of images distant by 20 steps

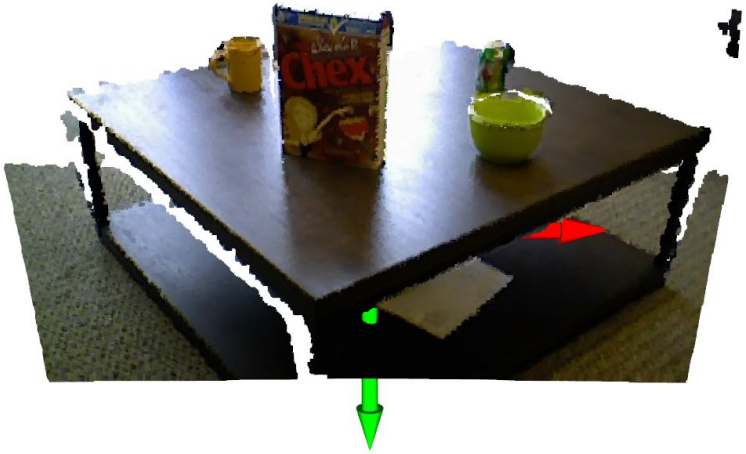


ICP



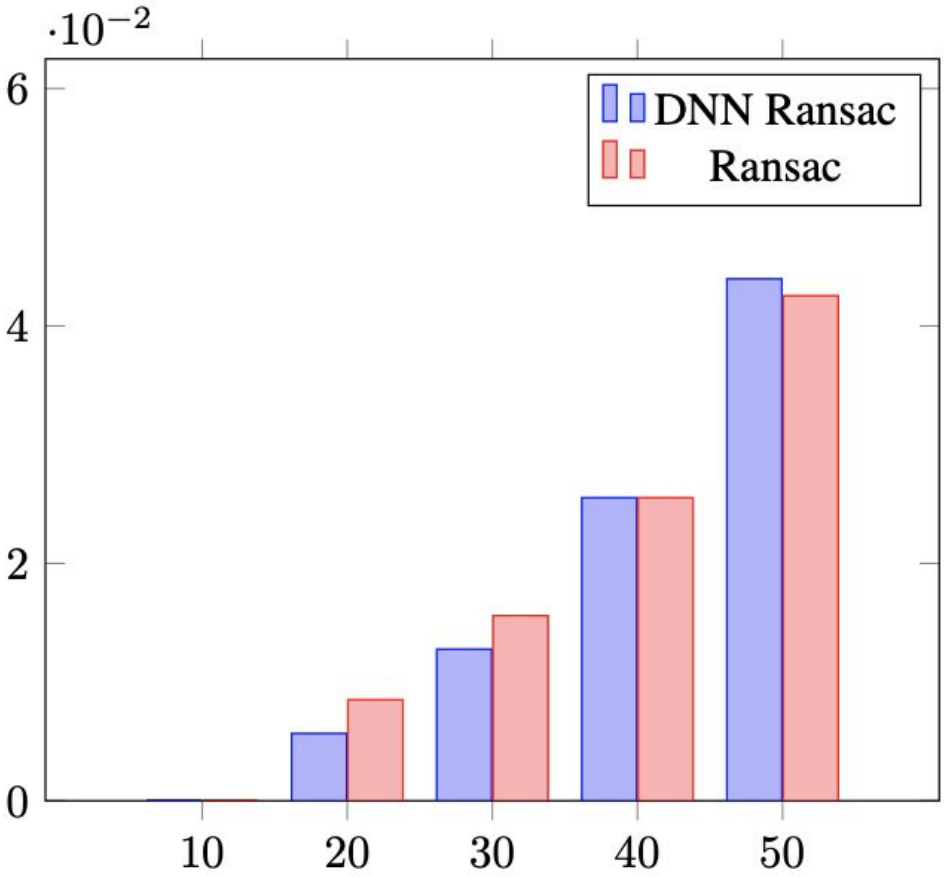
RGB 3D

POSE

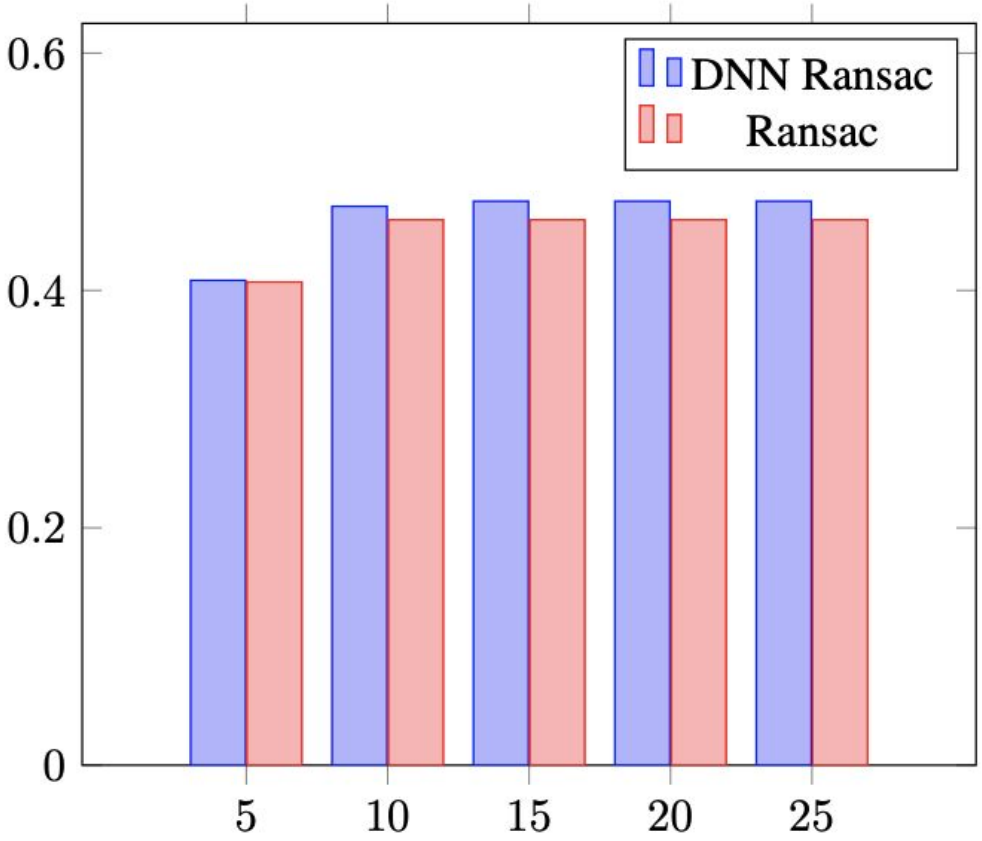


ANALYTICAL RESULTS

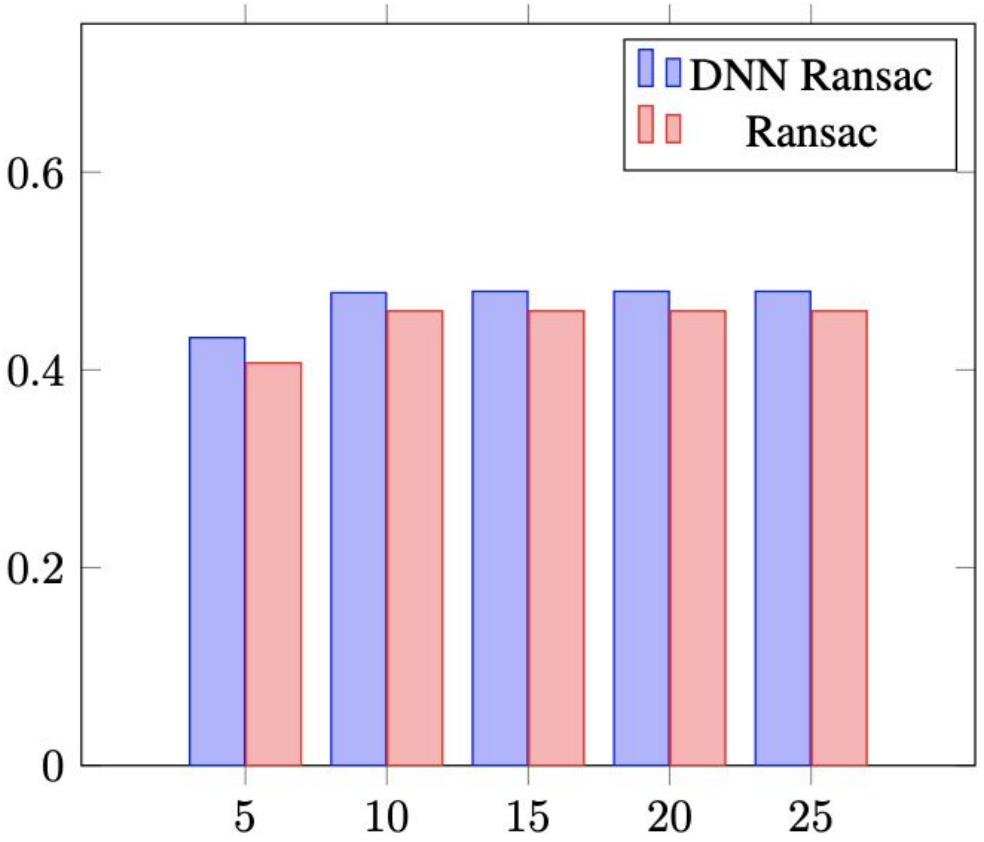
Photo tourism: Exploring photo collections in 3d



RGB (Washington Dataset)

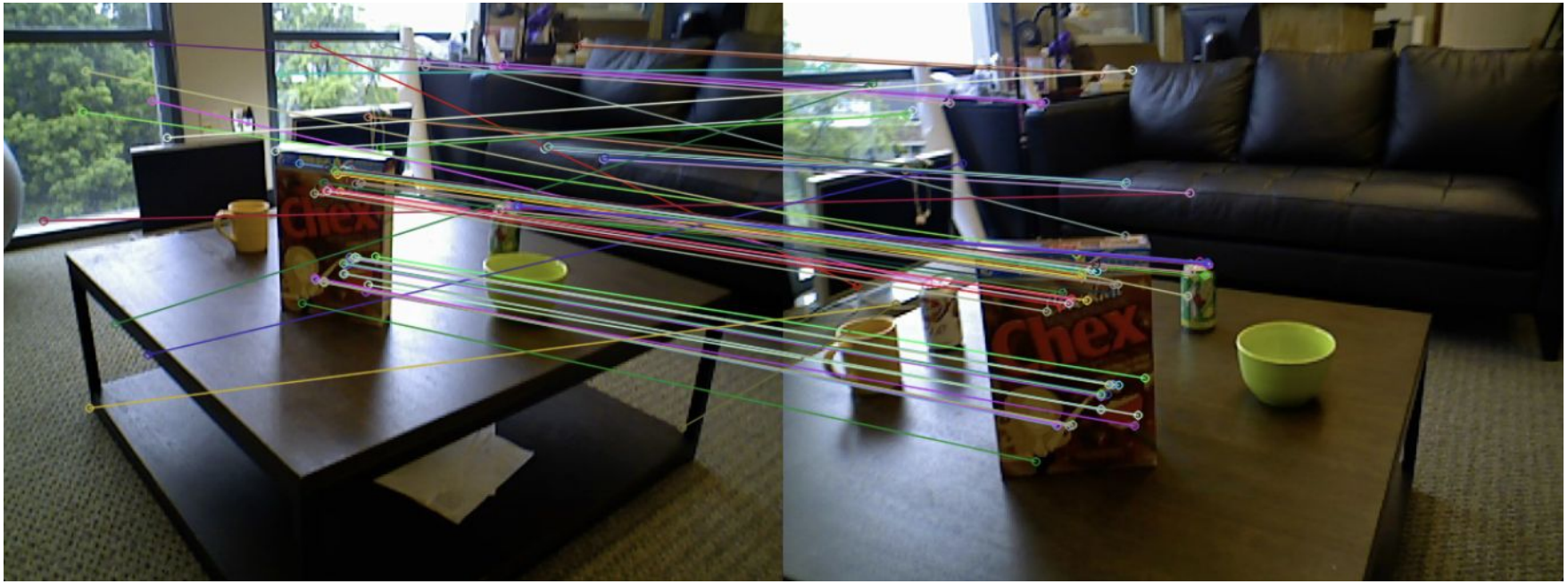


RGB-D (Washington Dataset)



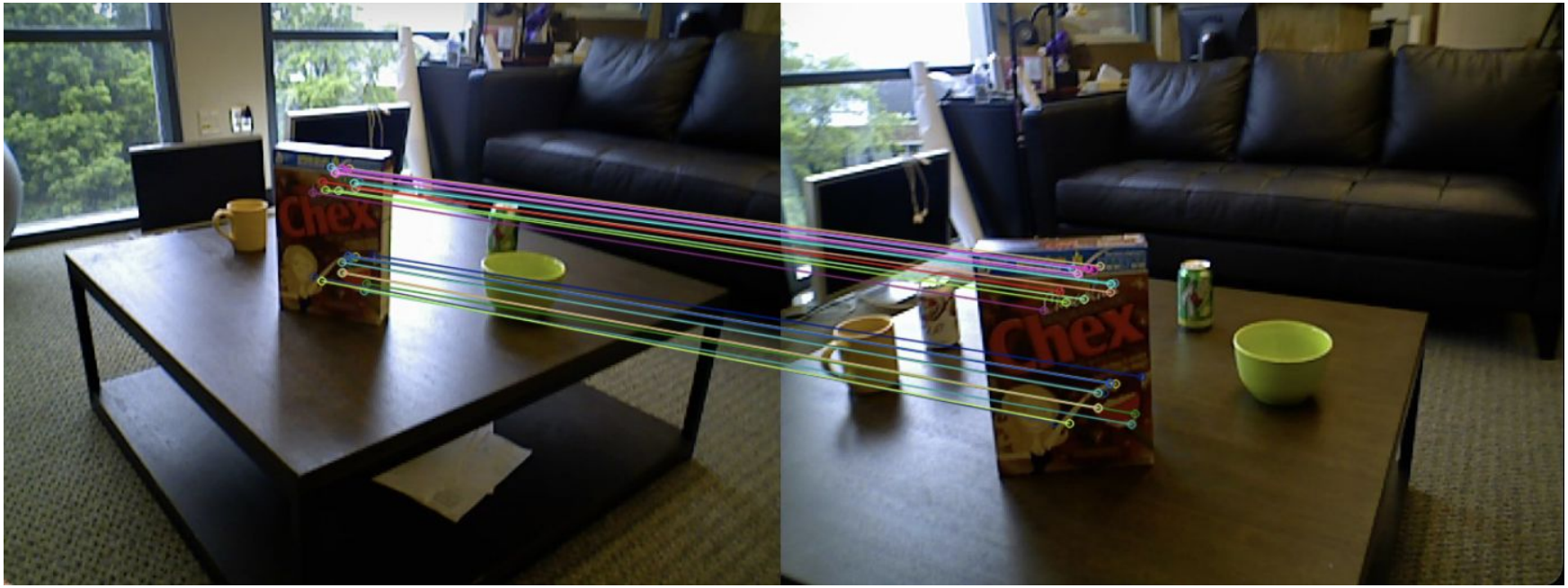
TESTING SET
VISUAL RESULTS

Detection + Matching without RANSAC



Computer Vision Pipeline (RANSAC)

Deep Learning Pipeline (DNN RANSAC)



THE END