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# Image Sensing Technology

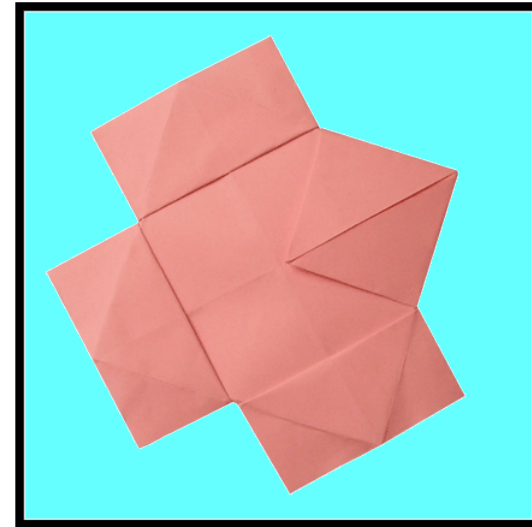
## Breaking the Limit of Pixel Resolution

Aoki Laboratory  
Graduate School of Information Sciences,  
Tohoku University, Japan

Prof. Takafumi Aoki  
Speaker: Mamoru Miura

# Image Matching

- Important fundamental task for image processing, pattern recognition and computer vision
- Purpose of image matching
  - Find corresponding point pairs between images:  
**Image correspondence**
  - Evaluate similarity between images:  
**Image similarity**



# Phase-Only Correlation (POC)

Measures the **linearity of phase difference** between images

Peak height      ▶ Similarity  
Peak location    ▶ Image shifts



Image 1

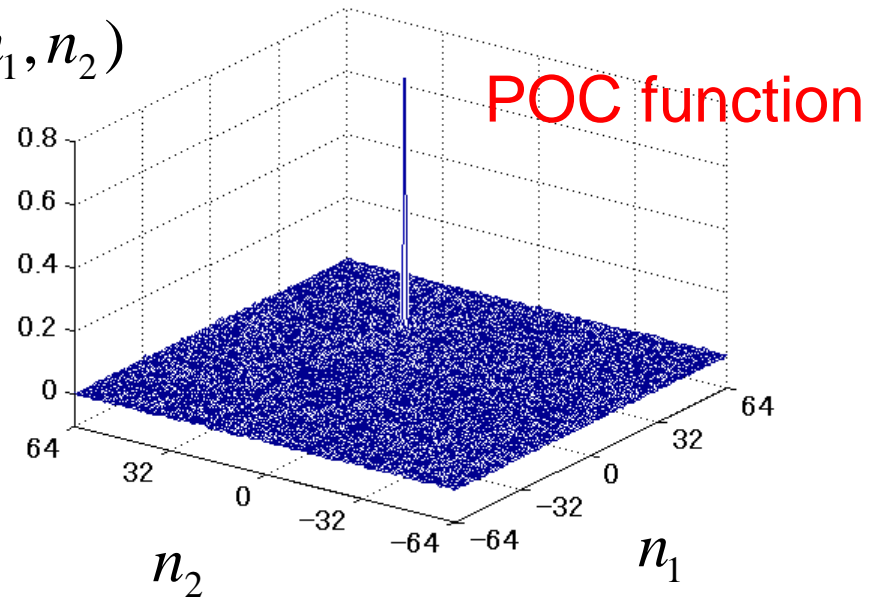


Image 2

2D  
DFT  
x3

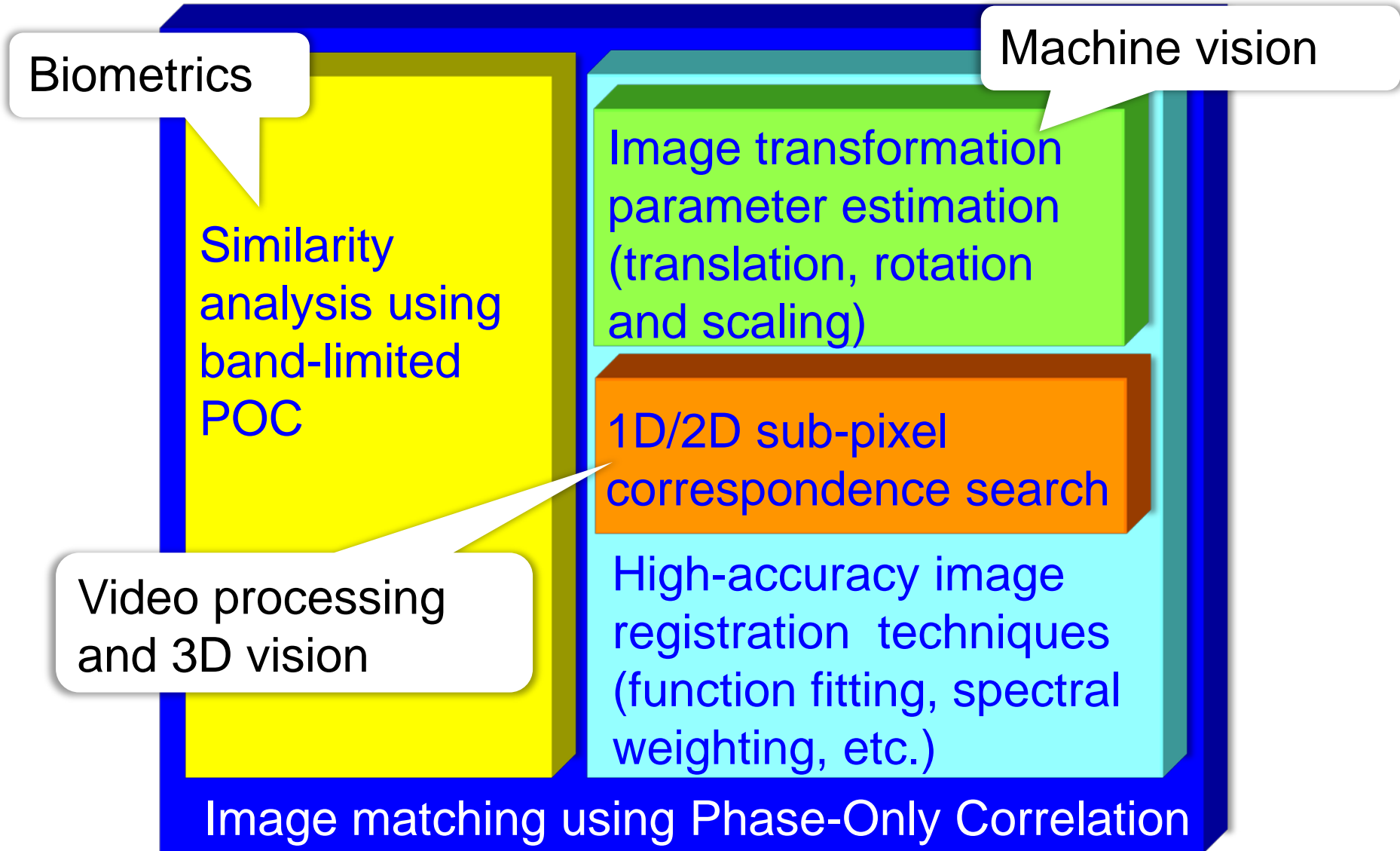


$r(n_1, n_2)$



- POC function has a sharp peak (i.e., a delta function).
- Registration accuracy is very high.

# Phase-Based Image Matching



# Applications of POC

3D measurement with moving camera

3D human capture

Projector-camera system

Robot vision

Automotive 3D vision system

Fusion of 3D medical data and 2D face image

Real-time 3D face capture

Dental radiograph identification

Palmprint verification app

Fingerprint verification unit

Iris verification unit

Scale estimation for electron microscope

Material testing machine

LCD manufacturing equipment

Defect inspection system

Component positioning equipment

Chip mouter

Wafer aligner

Bookbinding machine

Side-channel analysis

LSI tester

Waveform analysis against cryptographic circuits

Human interface

Object-based video processing

Robot vision

Biomedical imaging

Expression/gesture recognition

Image coding

Automotive 3D vision system

Remote sensing

Motion capture

Image editing/synthesis

Scale estimation for electron microscope

Image retrieval

Driver support system

Auto focus and drift cancel for electron microscope

3D camera

Range finder

Super resolution

Video surveillance

Laser speckle measurement

Camera parameter estimation

Video mosaicing

Computational photography

Seal recognition

Multimodal biometrics

Dental radiograph recognition

Image sensing

Material testing machine

LCD manufacturing equipment

Defect inspection system

Component positioning equipment

Chip mouter

Wafer aligner

Bookbinding machine

Side-channel analysis

LSI tester

2D/3D face recognition

Multimedia and computer vision

Machine vision

Biometrics and security

Waveform analysis

Hand recognition

Fingerprint recognition

Palmprint recognition

Vein recognition

Iris recognition