# 3个方面

### 3D object categorization and recognition

###### 06-PAMI-Rapid object indexing using locality sensitive hashing and joint 3D-signature space estimation (Matei)

###### 06-PAMI-Three-dimensional model-based object recognition and segmentation in cluttered scenes (Mian)

###### 10-IJCV-Real-time object recognition in sparse range images using error surface embedding (Shang & Greenspan)

###### 11-AAAI-A scalable tree-based approach for joint object and pose recognition(Lai)

###### 13-IJCV-Rotational projection statistics for 3D local surface description and object recognition (Guo)

### 3D modeling and scene reconstruction

###### 06-IJCV-A novel representation and feature matching algorithm for automatic pairwise registration of range images.(Mian)

###### 14-Multimedia-An accurate and robust range image registration algorithm for 3D object modeling (Guo)

### 3D shape retrieval and shape analysis

###### 11-TOG-Shape google: Geometric words and expressions for invariant shape retrieval (Bronstein)

###### 14-Multimedia-View-based 3-D object retrieval: Challenges and approaches.(Gao and Dai)

###### 92-PAMI-A method for registration of 3-D shapes (Besl and McKay)

### 3D biometrics

###### 14-PR-An efficient 3D face recognition approach using local geometrical signatures (Lei)

###### 15-Book-Feature selection for 2D and 3D face recognition

# 3种评判

### Descriptiveness

##### 8个dataset

### Compactness

##### Recall of feature matching per float value

### Robustness

##### 几种干扰

### Efficiency

# Robust

### Radius variations

### Gaussian noise

### Shot noise

### Varying mesh resolution

### Distance to the mesh boundary

### Keypoint localization error

### Occlusion

### Clutter

### Dataset size

# 不同的检测算法

# 两个主要步骤

### Keypoint-detection

##### Identify keypoints with rich information content

##### Determined their associated scales

###### ---[相关综述]---

10-IJCV-On the repeatability and quality of keypoints for local feature-based 3Dobject retrieval from cluttered scene（Mian）

13-IJCV-Performance evaluation of 3D keypoint detectors (Tombari)

### Feature description

##### Extract local geometric information around a keypoint

##### Store in a high dimensional vector

### Matching

##### ---[相关文献]---

10-ECCV-Unique signatures of histograms for local surface description (Tombari)

14-PAMI-3D object recognition in cluttered scenes with local surface features: A survey (Guo)

# ---[3D detector& descriptor综述]---

### Dectection+Description

###### 10-Workshop-SHREC2010: Robust feature detection and description benchmark (Bronstein)

###### 13-IJCV-Performance evaluation of 3D keypoint detectors (Tombari)

### Dectector

###### 10-Workshop-SHREC2010: Robust feature detection and description benchmark (Bronstein)

###### 11- 3DIMPVT-A performance evaluation of 3D keypoint detectors (Salti)

###### 11-Worshop-SHREC2011:Robust feature detection and description benchmark(Boyer)

###### 13-IJCV-Performance evaluation of 3D keypoint detectors (Tombari)

### Descriptor

* 12-BMVC-An evaluation of local shape descriptors in probabilistic volumetric scenes (Restrepo)

# ---[2D/3D detector/descriptor 综述]----

### 2D keypoint detector

###### 00-IJCV-Evaluation of interest point detectors (Schmid)

###### 04-IJCV-Scale&affine invariant interest point detectors (Mikolajczyk and Schmid)

###### 05-IJCV- A comparison of affine region detectors (Mikolajczyk)

###### 07-IJCV(ICCV)- Evaluation of features detectors and descriptors based on **3D** objects (Moreels and Perona)

### 2D local descriptor

###### 05-PAMI-A performance evaluation of local descriptors (Mikolajczyk) [比较方法]

###### 07-IJCV(ICCV)- Evaluation of features detectors and descriptors based on **3D** objects (Moreels and PeDSCrona)

###### 09-CVIU-Performance evaluation of local colour invariants (Burghouts and Geusebreok)

### 3D keypoint detector

###### 10-Workshop-SHREC2010: Robust feature detection and description benchmark (Bronstein)

###### 11-Worshop-SHREC2011:Robust feature detection and description benchmark(Boyer)

###### 11- 3DIMPVT-A performance evaluation of 3D keypoint detectors (Salti)

###### 12-3DIMPVT-On the affinity between 3D detectors and descriptors(Salti)

###### 13-IJCV-Performance evaluation of 3D keypoint detectors (Tombari)

###### 14-ICCVTA-comparative evaluation of 3D keypoint detectors in a RGB-D object dataset(Filipe)

### 3D feature descriptor

###### 14-ACCV-Performance evaluation of 3D local feature descriptors(Guo)

# ---[3D feature descriptor 综述]---

#### 10-Workshop-SHREC2010: Robust feature detection and description benchmark (Bronstein)

### |||3D shape retrieval|||

##### Heat kernel Signatures (HKS)[Sun 2009]

09--A concise and provably informative multi-scale signature based on heat diffusion(Sun)

##### Spin image(SI)

99-Using spin images for efficient object recognition in cluttered 3D scenes(Johnson and Hebert)

#### 11-Worshop-SHREC2011:Robust feature detection and description benchmark(Boyer)

### |||3D shape retrieval|||

##### Mesh-HoG

09-CVPR-Sur-face feature detection and description with applications to mesh matching (Zaharescu)

##### Scale-Invariant Spin Image(SISI)

12-TIP-Scale invariant features for 3D mesh model (Darom and Keller)

##### Local depth SIFT

12-TIP-Scale invariant features for 3D mesh model (Darom and Keller)

##### Generalized HKS(GHKS)

????

#### 12--3D descriptors for object and category recognition: A comparative evaluation (Alexandre)

### |||3D object and category recognition for local/global|||

##### Combine color and shape information

#### 13-IC3DV-Evaluation of 3D feature descriptors for multi-modal data registration (Kim,Hilton)

#### ||A framework for2D/3D multi-modal data registration|||

##### Spin Image(SI)

##### 3D shape context (3DSC)

04-ECCV-Recognizing objects in range data using regional point descriptors (Frome)

##### Fast point feature histogram (FPFH)

09-ICRA-Fast point feature histograms (FPFH)for3Dregistration (Rusu)

##### Signature of histogram of orientations(SHOT)

10-Unique signatures of histograms for local surface description (Tombari)

14-SHOT: Unique signatures of histograms for surface and texture description

#### 12-BMVC-An evaluation of local shape descriptors in probabilistic volumetric scenes (Restrepo)

### |||probabilistic volumetric models of large-scale urban scene using Bag-of-Word|||

##### SI

##### 3DSC

##### SHOT

##### FPFH

#### 12-3DIMPVT-On the affinity between 3D detectors and descriptors(Salti)

### |||Seven descriptors +Eight detector|||

##### Intrinsic shape signatures(ISS) for the best detector

##### SHOT for the best descriptor

# ---[3D feature descriptor 介绍]---

### Spatial distribution histogram

##### Construction of a Local Reference Frame/Axis (LRF/A) for the keypoint, and partition the 3D support region into several bins according to the LRF/A

##### Generate a histogram for the local surface by accumulating the spatial distribution measurements in each spatial bin

### Geometric attribute histogram

##### Generate histogram according to the geometric attributes

# ---[3D feature descriptor 详述]---

## ||| Spatial distribution histogram|||

### Spin image(SI)

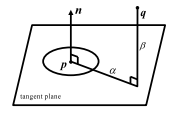
#### |||原文|||

###### 99-Using spin images for efficient object recognition in cluttered 3D scenes(Johnson and Hebert)

LRA: surface normal ***n*** at the keypoint

Histogram: *(*

Dimension：, is the number of bins along each dimension of *(*



#### |||变形|||

###### 01-CVPR-A new signature-based method for efficient 3-D object recognition (Ruiz-Corread)

###### 06-CVPR-Multi-resolution spin-images(Dinh and Kropac)

###### 07-Multimead-Content-based retrieval of 3-D objects using spin image signatures (Assfalg)

###### 12-TIP-Scale invariant features for 3D mesh models (Darom and Keller)

### 3D Shape context (3DSC)

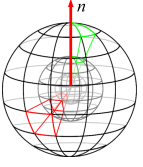
#### |||原文|||

###### 04-ECCV-Recognizing objects in range data using regional point descriptors (Frome)

LRA: surface normal ***n*** at the keypoint

Histogram:

Dimension:



#### |||变形|||

###### 04-ECCV-Recognizing objects in range data using regional point descriptors (Frome)

###### 10-ECCV-Unique signatures of histograms for local surface description (Tombari)

### Unique Shape Context (USC)

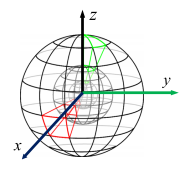
#### |||原文|||

###### 10-3D Object Retrieval-Unique shape context for 3Ddata description (Tombari)

LRF: 参考10-ECCV(Tombari)

Histogtam: ???

Dimension : the same as 3DSC



### Rotational Projection Statistics (RoPS)

#### |||原文|||

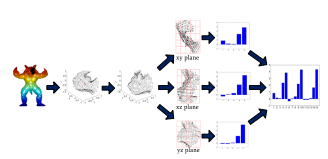
###### 13-Workshop-3D free form object recognition using rotational projection statistics (Guo)

###### 13-IJCV-Rotational projection statistics for 3D local surface description and object recognition (Guo)

LRF: ???

Histogram: ???

Dimension:



### Tri-Spin-Image (TriSI)

#### |||原文|||

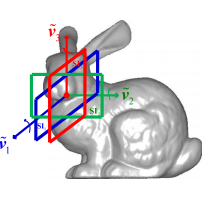
###### 13-GRAPP/IVAPP-TriSI: A distinctive local surface descriptor for 3D modeling and object recognition (Guo)

###### 15-Information Sciences-A novel local surface feature for 3D object recognition under clutter and occlusion

LRF: 参考RoPS

Histogram: 3 X SI

Dimension:



### 3D Tensor descriptor

###### 06-PAMI- Three-dimensional model-based object recognition and segmentation in cluttered scenes (Mian)

LRF: Use a pair of points and their surface normal

Histogram: 3D grid

Dimension: ??? Tensor

### Spin image signature

###### 07-Multimead-Content-based retrieval of 3-D objects using spin image signatures (Assfalg)

### Multi-resolution spin image

###### 06-CVPR-Multi-resolution spin-images(Dinh and Kropac)

### Asymmetry Shape context

###### 13-ICCGTA-Rotationally invariant 3D shape contexts using asymmetry patterns (Sukno)

## ||| Geometric attribute histogram |||

### Local Surface Patch (LSP)

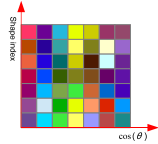
###### 07-PRL- 3D free-form object recognition in range images using local surface patches (Chen and Bhanu)

###### 07-PAMI- Human ear recognition in 3D (Chen and Bhanu)

###### 92-IVC- Surface shape and curvature scales (Koenderink and Doorn){Shape Index}

Histogram: (Shape Index, cosine of angle)

Dimension:



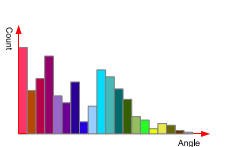
### THRIFT

###### 07-DICTA- THRIFT: Local 3D structure recognition (Flint)

###### 08-IET CV- Local 3D structure recognition in range images (Flint)

Histogram: (cosine between normal)

Weight: density of point samples and the distance from the neighbor



### Point Feature Histogram (PFH)

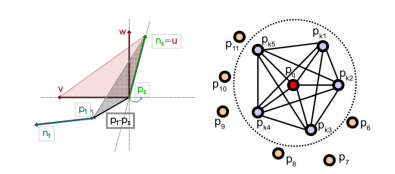
###### 08-ICIRS- Aligning point cloud views using persistent feature histograms(Rusu)

###### 09-ICRA- Fast point feature histograms (FPFH)for3Dregistration (Rusu) {improved}

Darboux frame: defined by the surface normal and pint positions

Histogram: four feature using(Darboux frame, the surface normal, point position)

Dimension: , (improved)

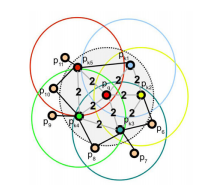


### Fast Point Feature Histogram (FPFH)

###### 09-ICRA- Fast point feature histograms (FPFH)for3Dregistration (Rusu) {improved}

Fist: SPFH is calculated between point and neighbours

Second: Weighted Sum



### Signature of Histogram of Orientations (SHOT)

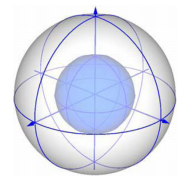
###### 10-ECCV-Unique signatures of histograms for local surface description (Tombari)

###### 14-CVIU-SHOT: Unique signatures of histograms for surface and texture description (Salti)

LRF:???

Histogram: (

USC+normal bin division?



### variable-dimensional local shape (VD-LSD)

###### 11-CVIU-Local shape descriptor selection for object recognition in range data (Taati and Greenspan)

An eigenvalue decomposition is first performed on the covariance matrix of each point to obtain several invariant properties for that point

accumulating the neighboring points into histogram bins according to their invariant properties

### 2.5D SIFT

###### 09-CVIU-Local feature extraction and matching on range images: 2.5D SIFT (Lo and Siebert)

Extend the SIFT to depth images

### SI-SIFT

###### 10-ICPR-Shape index SIFT: Range image recognition using local features (bayramoglu and Alatan)

Using SIFT to extract descriptors from shape index

# ---[3D feature dataset 介绍] ---

#### 14--Benchmark datasets for 3D computer vision (guo)

# ---[ Dataset ]---

### 不同采集技术

##### Retrieval and Random views datasets

Using models

From the Stanford 3D scanning repository

3D model, 3D scene||Shape Retrieval

##### Random views datasets

Using models

From the Stanford 3D scanning repository

3D models, 2.5D scene||Object Recognition

##### The Laser scanner

Using Laser scanner

From Mian 2006

3D models, 2.5D scene||Object Recognition

##### 2.5D Views

Using Laser scanner

From Mian 2006

Only 3D models||modeling

##### LIDAR dataset

Using Laser scanner(Higher quality)

From Taati and Greenspan 2011

3D models, 2.5D scene||Object Recognition

##### Dense stereo

Using low-resolution Bumblebee stereo camera

From Taati and Greenspan 2011

3D models, 2.5D scene||Object Recognition

##### Space Time dataset

Using the Space Time stereo acquisition technique

From Tombari 2013

2.5D model, 2.5D scene||Object Recognition

##### Kinect dataset

Using Microsoft Kinect v1

From Tombari 2013

2.5D model, 2.5D scene||Object Recognition

### 

# ---[ Groudtruth 相关文献 ]---

#### 06-PAMI-Three-dimensional model-based object recognition and segmentation in cluttered scenes (Mian)

#### 10-ECCV-Unique signatures of histograms for local surface description (Tombari)

#### 11-CVIU-Local shape descriptor selection for object recognition in range data (Taati and Greenspan)

#### 13-IJCV-Performance evaluation of 3D keypoint detectors (Tombari)

# ---[ 实现细节 ]---

### 点云处理

##### Convert to triangle meshes

13-IJCV-Rotational projection statistics for 3D local surface description and object recognition (guo)

##### 法向量

先求三角形的法向量

点的法向量为各个面的均值

10-IJCV-On the repeatability and quality of keypoints for local feature-based 3Dobject retrieval from cluttered scenes (Mian)

12-IJCV-Keypoints and local descriptors of scalar functions on 2D manifolds (Zaharescu)

##### The mean/Gaussian curvatures and shape index values

92-ECCV-Intrinsic surface properties from surface triangulation (Chen and Schmiit)