CVonline Subject Linkages

A part of the CVonline computer vision resource summarizing the geometric and mathematical methods commonly encountered in computer vision and image processing.

1. Basic Representations
   1. Coordinate systems
      1. Cartesian coordinate system
      2. Cylindrical coordinate system
      3. Hexagonal coordinate system (see external links)
      4. Log-Polar coordinate system
      5. Polar coordinate system
      6. Spherical coordinate system
   2. Digital topology
   3. Dual space
   4. Homogeneous coordinates
   5. Pose/Rotation/Orientation Representations
      1. Axis-angle representation
      2. Clifford algebra
      3. Euler angles
      4. Exponential map
      5. Quaternion/Dual quaternion
      6. Rotation matrix
      7. Pitch/Yaw/Roll

2. Distance and similarity metrics
   1. Affine distance
   2. Algebraic distance
   3. Bregman divergence
   4. Bhattacharyya distance
   5. Chi-square test/metric
   6. Curse of dimensionality
   7. Earth mover's distance
   8. Euclidean distance
   9. Fuzzy intersection
   10. Hausdorff distance
   11. Jaccard Index
   12. Jeffrey divergence
   13. Jensen-Shannon Divergence
   14. Kullback-Leibler divergence
<table>
<thead>
<tr>
<th>Sitemap</th>
</tr>
</thead>
<tbody>
<tr>
<td>System models, calibration and parameter estimation methods</td>
</tr>
<tr>
<td>Visual learning related methods and concepts</td>
</tr>
</tbody>
</table>

| 15. Mahalanobis distance |
| 16. Manhattan/City block distance |
| 17. Minkowski distance |
| 18. Procrustes analysis |
| 19. Quadratic form |
| 20. Sørensen-Dice coefficient |
| 21. Specific structural similarity |
| 1. Curve similarity |
| 2. Region similarity |
| 3. Volume similarity |

| 3. Elementary mathematics for Vision |
| 1. Coordinate systems/Vectors/Matrices/Derivatives/Gradients/Probability |
| 2. Derivatives in sampled images |

| 4. Mathematical optimization |
| 1. Golden section search |
| 2. Lagrange multipliers/Constraint optimization |
| 3. Multi-dimensional optimization |
| 1. Random optimization |
| 2. Global optimization |
| 1. Ant colony optimization |
| 2. Downhill simplex |
| 3. Genetic algorithms |
| 4. Graduated optimization |
| 5. Markov random field optimization |
| 6. Particle swarm optimization |
| 7. Simulated annealing |
| 3. Optimization with derivatives |
| 1. Levenberg-Marquardt |
| 2. Gradient descent |
| 3. Quasi-Newton method |

| 4. Model selection |
| 5. Variational methods |

| 5. Linear algebra for computer vision |
| 1. Eigenfunction |
| 2. Eigenvalues and eigenvectors |
| 3. Norms |
| 1. Frobenius |
| 2. Hamming |
| 3. L or p norms (1, 2, ∞) |
| 4. Manhatten or taxi |
| 5. Nuclear |
| 6. Spectral |
| 4. Principal component and Related Approaches |
| 1. Dimensionality reduction |
| 2. Linear discriminant analysis |
| 3. Factor analysis |
| 4. Fisher's linear discriminant |
| 5. Independent component analysis |
|---|----------------------------------------|----------------------------------------|----------------------------------|-------------------------------------|----------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-----------------------------|
8. Trifocal tensor
6. Image-based modeling and rendering
7. Plenoptic modeling
8. Image feature correspondence
   1. Active stereo
   2. Disparity gradient limit (feature correspondence)
   3. Epipolar constraint
   4. Feature contrast
   5. Feature orientation
   6. Grey-level similarity (feature correspondence)
   7. Lipschitz continuity
   8. Surface continuity
   9. Surface smoothness
   10. View consistency constraint
9. Scene reconstruction/Surface interpolation
   1. Adaptive mesh refinement
   2. Constrained reconstruction
   3. Thin plate models
   4. Texture synthesis/Texture mapping
   5. Triangulation
   6. Volumetric reconstruction
      1. Visual hull
   10. Trinocular (and more) stereo
7. Parameter Estimation
   1. Bayesian methods
   2. Constrained least squares
   3. Linear least squares
   4. Optimization
   5. Robust techniques
8. Probability and Statistics for Computer Vision
   1. Autoregression
   2. Bayes estimator
   3. Bayesian inference networks
   4. Canonical correlation
   5. Causal models
   6. Correlation and dependence
   7. Covariance and Mahalanobis distance in Vision
   8. Dempster–Shafer theory
   9. Density estimation
   10. Gaussian or Normal distribution
   11. Heteroscedastic noise
   12. Hidden Markov models
   13. Homoscedastic noise
   14. Information theory
   15. Kalman filters
      1. Unscented Kalman filters
   16. Kernel regression
17. Least mean squares estimation
18. Least median square estimation and estimators
19. Log-normal distribution
20. Logistic regression
21. Markov chain/Markov chain Monte Carlo methods
22. Markov random field
   1. Applications
   2. Conditional random fields
   3. Multi-level Markov random fields
   4. Optimization methods
      1. Gibbs sampling
      2. Graduated optimization
      3. Graph cuts in computer vision
      4. Iterated conditional modes
      5. Simulated annealing
23. Maximum likelihood
24. Mixture models and expectation-maximization (EM)
   1. Gaussian mixture model
   2. Categorical mixture model
25. Model/Curve fitting
26. Monte Carlo method
27. Multimodal distribution
28. Normalization
29. Non-parametric statistics
   1. Non-parametric regression
   2. Kernel density estimation
30. Point process
31. Poisson distribution
32. Probability axioms
33. Random number generation
34. Robust estimators
35. Statistical hypothesis testing/Analysis of variance
36. von-Mises-Fisher and other directional statistics
9. Projective geometry/Projective transformations
   1. Affine projection model/Affine transformation
   2. Anamorphic projection/Catadioptric system
   3. Central cylindrical projection
   4. Orthographic projection
   5. Map projection
   6. Homography
   7. Hierarchy of geometries
   8. Perspective projection
   9. Projective plane
10. Projective space
11. Real camera projection
12. Similarity matrix
13. Weak-perspective
1. Tomasi-Kanade factorization
10. Projective invariants/cross-ratio
   1. Absolute points (points at infinity)
   2. Affine invariants
      1. Affine geometry of curves
   3. Collineation
   4. Conics/Quadrics
   5. Coplanarity
   6. Differential invariants
   7. Duality
   8. Integral invariants
   9. Laguerre formula
   10. Pencils
11. Quasi-invariants
12. Structural invariants
   1. Cartan's equivalence method
11. Relational shape descriptions
   1. Curves
      1. Adjacency/Connectedness
      2. Relative curvature
      3. Relative length
      4. Relative orientation
      5. Separation
   2. Regions
      1. Adjacency/Connectedness
      2. Relative area/size
      3. Separation
   3. Surfaces
      1. Adjacency/Connectedness
      2. Relative area/size
      3. Relative orientation
      4. Separation
   4. Volumes
      1. Adjacency/Connectedness
      2. Relative orientation
      3. Relative volume/size
      4. Separation
12. Shape properties
   1. Geometric Morphometrics
   2. Kendall's Shape Space
   3. Points and local invariants
      1. Scale-invariant feature transform
   4. Curves and Curve Invariants
      1. Affine curvature
      2. Arc length
      3. Bending energy
      4. Chord distribution
      5. Curvature, Torsion of a curve, Radius of curvature
6. **Differential geometry, Frenet-Serret formulas**

7. **Invariant Points:** Inflections/Bitangents

5. **Image regions and region invariants**
   1. Compactness measure of a shape
   2. Area
   3. Perimeter
   4. Center of mass, Centroid
   5. Eccentricity, Elongatedness
   6. Euler number/Genus
   7. Extremal points
   8. Feret’s diameter
   9. **Fourier descriptors**
   10. Minimum bounding rectangle
   11. **Image moments**
       1. Affine moments
       2. Bessel-Fourier moments
       3. Binary moments
       4. Color moments
       5. Central moments
       6. Eigenmoments
       7. Fourier-Mellin moment invariants
       8. Gaussian-Hermite moments
       9. Texture moments
       10. Hahn moments
       11. **Krawtchouk moments**
       12. Legendre moments
       13. Orthogonal moments
       14. Racah moments
       15. Chebyshev moments
       16. Zernike and velocity moments
   12. **Orientation**
   13. **Sphericity**
   14. **Rectangularity**
   15. **Rectilinearity**
   16. **Roundness**
   17. **Topological invariants**
       1. Euler characteristic

6. **Differential geometry of surfaces**
   1. **Parametric surfaces**
   2. **Common shape classes and representations**
      1. Cone representations
      2. Cyclide
      3. Cylinder representations
      4. Ellipsoid/Sphere Representations
      5. Thin plate splines
      6. Plane representations
      7. Polyhedra representations
8. Quadric representations
9. Torus representations
3. Fundamental surface forms
   1. First fundamental form
   2. Second fundamental form
4. Gauge coordinates
5. Hessian
6. Laplace–Beltrami operator
7. Metric derivative
8. Principal curvature and directions and other local shape representations
   1. Deviation from flatness
   2. Gauss–Bonnet surface description
   3. Gaussian curvature
   4. Koenderink's shape classification
   5. Mean curvature
   6. Minimal surface
   7. Parabolic points
   8. Ridges
   9. Umbilics
9. Quadratic variation
10. Ricci flow
11. Surface area
12. Surface normals and tangent planes
13. Orientability
7. Symmetry
   1. Affine symmetry
   2. Bilateral symmetry
   3. Rotational symmetry
   4. Skew symmetry
8. Volumes
   1. Elongatedness
   2. 3D moments and moment invariants
9. Volume
13. Transformations (geometric), registration and pose estimation methods
   1. Pose estimation
   2. 2D to 2D pose estimation
      1. Methods
   3. 2D to 3D pose estimation
      1. Methods
   4. 3D to 3D pose estimation
      1. Methods
   5. Affine transformation
      1. Minimal data estimation
   6. Bundle adjustment
   7. Euclidean transformation
      1. Least-square euclidean transformation estimates
2. Minimal data Euclidean transformation estimation
3. Robust Euclidean transformation estimates
8. Homographic transformation
   1. Least-square homography transformation estimates
   2. Robust homography transformation estimates
9. Kalman filter pose estimation methods
10. Partially constrained pose
    1. Incomplete information
    2. Intrinsic degrees of freedom
11. Projective transformation
    1. Direct linear transformation
    2. Robust estimates
12. Similarity transformation
13. Articulated body pose estimation

Comments

You do not have permission to add comments.