Computing Methods for Experimental Physics and Data Analysis

Data Analysis in Medical Physics

Lecture 5a (Hands-on): Defining function, Code vectorization; interpolation methods for image transformation and resizing

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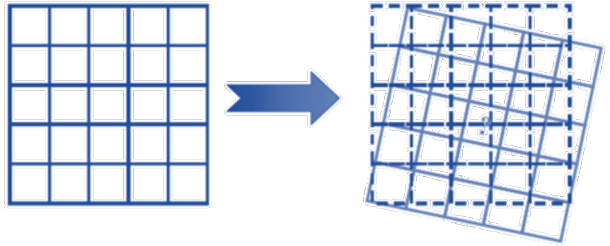
Performance issues in Matlab

- MATLAB is:
  - very fast on vector and matrix operations
  - correspondingly slow with loops
- MATLAB is a matrix-based language. Avoiding for loops, and using matrices is useful:
  - sometimes for speed
  - sometimes to improve code readability and easy maintenance
- Thus:
  - Try to avoid loops
  - Try to vectorize your code

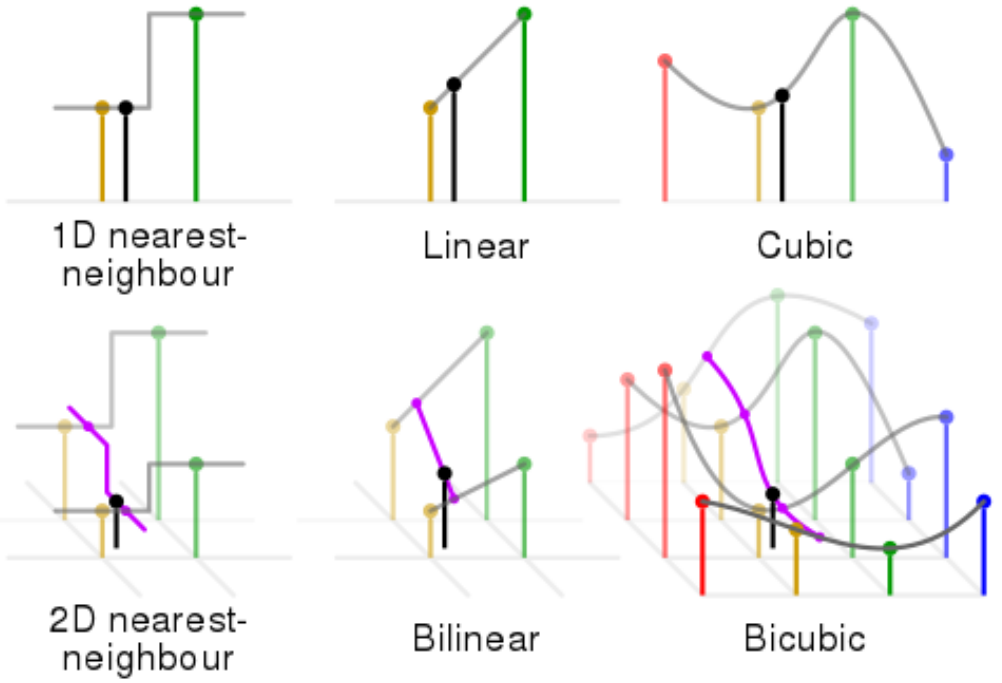
See demo code:
- show_diamond.m
  - diamond.m
  - (diamond_bad.m)

Image transformations

- Geometric transformations: translation, rotation, scaling, shear

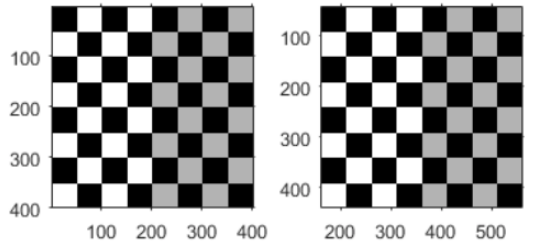
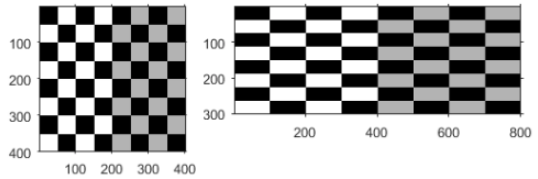
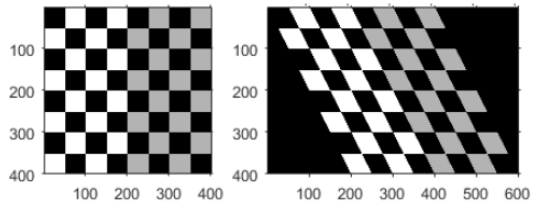
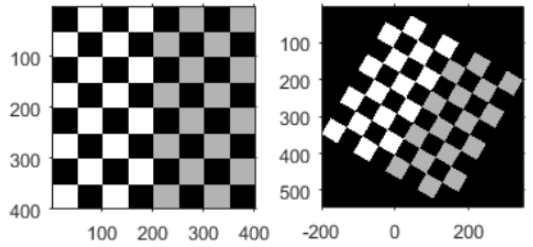


- Transformed images often need resampling; an interpolation method should be specified, e.g.:
  - Nearest neighbor
  - Bilinear interpolation
  - Bicubic interpolation



Exercise: Lecture5_exercise.m

2D affine transformation

2-D Affine Transformation	Example (Original and Transformed Image)	Transformation Matrix	
Translation		$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ t_x & t_y & 1 \end{bmatrix}$	t_x specifies the displacement along the *x* axis t_y specifies the displacement along the *y* axis. For more information about pixel coordinates, see Image Coordinate Systems.
Scale		$\begin{bmatrix} s_x & 0 & 0 \\ 0 & s_y & 0 \\ 0 & 0 & 1 \end{bmatrix}$	s_x specifies the scale factor along the *x* axis s_y specifies the scale factor along the *y* axis.
Shear		$\begin{bmatrix} 1 & sh_y & 0 \\ sh_x & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	sh_x specifies the shear factor along the *x* axis sh_y specifies the shear factor along the *y* axis.
Rotation		$\begin{bmatrix} \cos(q) & \sin(q) & 0 \\ -\sin(q) & \cos(q) & 0 \\ 0 & 0 & 1 \end{bmatrix}$	q specifies the angle of rotation about the origin.

Exercise:
- Lecture5_exercise.m