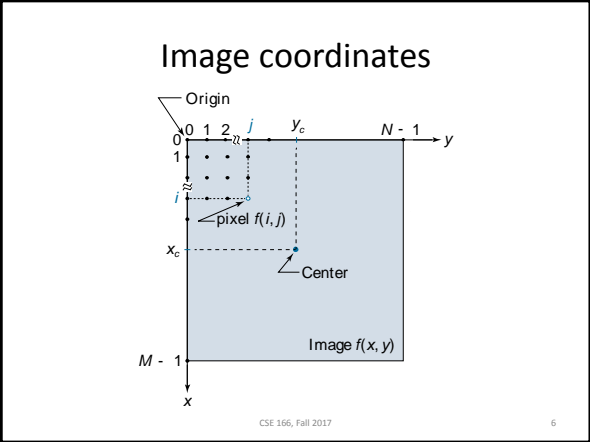
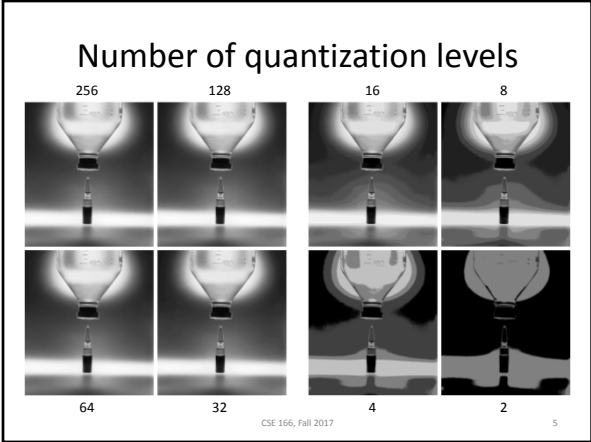
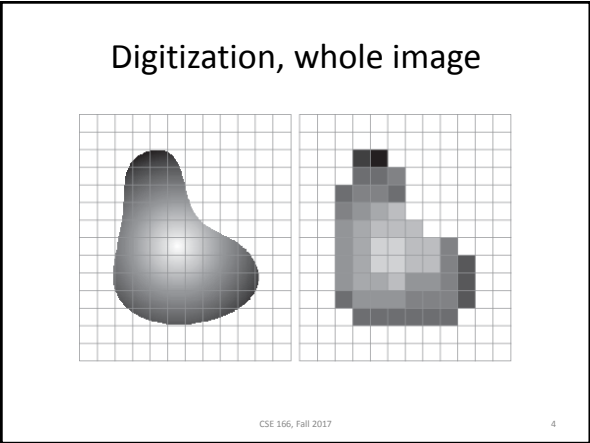
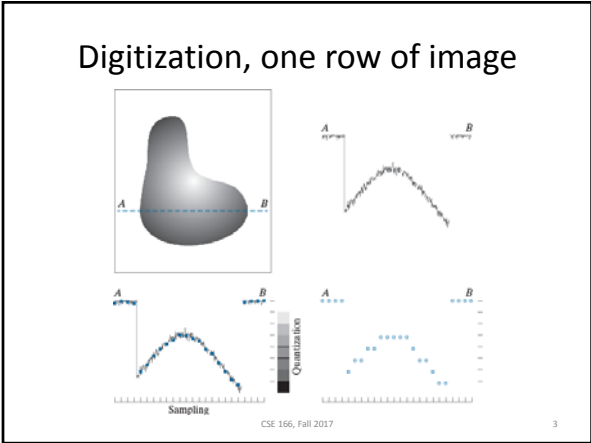
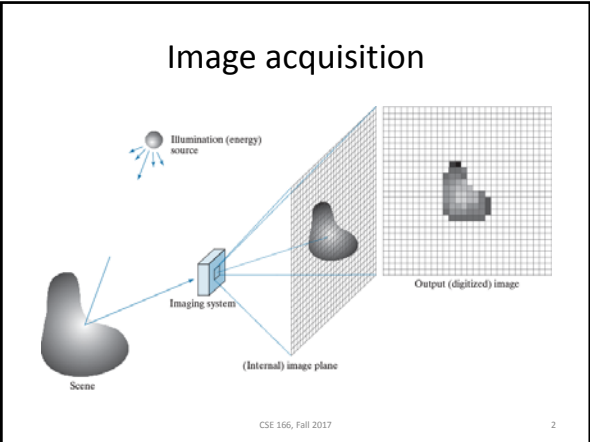


Image Acquisition, Geometric Transformations, and Image Interpolation

Image Processing
CSE 166
Lecture 2



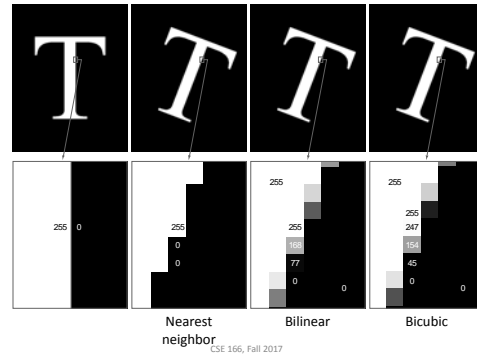
Geometric transformations

| Transformation Name | Alpha Matrix, A | Coordinate Equations | Example |
|---|--|--|---------|
| Identity | $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ | $x' = x$ $y' = y$ | |
| Scaling/Reflection (For reflection, set one scaling factor to -1 and the other to 1) | $\begin{bmatrix} s_x & 0 & 0 \\ 0 & s_y & 0 \\ 0 & 0 & 1 \end{bmatrix}$ | $x' = s_x x$ $y' = s_y y$ | |
| Rotation (about the origin) | $\begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$ | $x' = x \cos \theta - y \sin \theta$ $y' = x \sin \theta + y \cos \theta$ | |
| Translation | $\begin{bmatrix} 1 & 0 & t_x \\ 0 & 1 & t_y \\ 0 & 0 & 1 \end{bmatrix}$ | $x' = x + t_x$ $y' = y + t_y$ | |
| Shear (vertical) | $\begin{bmatrix} 1 & s_x & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ | $x' = x + s_x y$ $y' = y$ | |
| Shear (horizontal) | $\begin{bmatrix} 1 & 0 & 0 \\ s_y & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ | $x' = x$ $y' = s_y x + y$ | |

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Transformation with interpolation



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