UNIVERSITY OF ILLINOIS
Department of Electrical and Computer Engineering
ECE 417 Multimedia Signal Processing

Lecture 20 Sample Problems

Problem 20.1

Suppose you want to generate an output image $J[x, y]$ from an input image $I(u, v)$ according to

$$J[x, y] = I(u, v)$$

where x is the row index (measured from top to bottom), and y is the column index (measured from left to right). You want the output image to be scaled horizontally by a factor of 1.5, then shifted to the left by 20 pixels, then rotated by an angle of 30 degrees. That means that the input image is rotated by -30 degrees, then shifted right by 20 pixels, then scaled horizontally by 2/3. Find an affine transform matrix that implements this transformation as $\vec{u} = A\vec{x}$, where $\vec{x} = [x, y, 1]^T$, and $\vec{u} = [u, v, 1]^T$.

Problem 20.2

Suppose you want to generate an output image $J[x, y]$ from an input image $I(u, v)$ according to

$$J[x, y] = I(u, v)$$

This problem is similar to the previous one, except that now you want the input image to be generated from the output by scaling first, then shifting, then rotating. Find an affine transform matrix that implements this transformation as $\vec{u} = A\vec{x}$.