# CS754 Assignment 3 Report

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## Contents

## Introduction

Welcome to our report on CS754 Assignment 3. We have tried to make this report comprehensive and self-contained. We hope reading this would give you a proper flowing description of our work, methods used and the results obtained.

Hope you enjoy reading the report. Here we go!

# 1 Problem 1

# 2 Problem 2

# 3 Problem 3

# 4 Problem 4

# 5 Problem 5

We know that Radon Transform is given by-

$$R_\theta(f) = g(\rho,\theta) = \int_{-\infty}^{+\infty} f(\rho cos\theta - zsin\theta, \rho sin\theta + zcos\theta)dz$$

We can write the same as-

$$R_\theta(f) = g(\rho,\theta) = \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} f(x,y)\delta(xcos\theta + ysin\theta - \rho)dxdy$$

Let the scaled image be denoted by $h(x.y) = f(ax, ay)$. This is the same image as original, but scaled by a factor of a, in both x and y directions.

We can write the same Radon Transform as-

$$R_\theta(h) = g'(\rho,\theta) = \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} h(x,y)\delta(xcos\theta + ysin\theta - \rho)dxdy$$

$$R_\theta(h) = g'(\rho,\theta) = \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} f(ax,ay)\delta(xcos\theta + ysin\theta - \rho)dxdy$$

$$R_\theta(h) = g'(\rho,\theta) = \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} f(x',y')\delta\left(\frac{x'cos\theta + y'sin\theta - a\rho}{a}\right)\frac{dx'}{a}\frac{dy'}{a}$$

Since $\delta(ax) = \delta(x)/a$, we get-

$$R_\theta(h) = g'(\rho,\theta) = \frac{1}{a}\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} f(x',y')\delta(x'cos\theta + y'sin\theta - a\rho)dx'dy'$$

$$R_\theta(h) = g'(\rho,\theta) = \frac{1}{a}g(a\rho,\theta)$$

Thus, we can see that the Radon transform of the scaled image is also scaled by a factor of $a$ in the size of projection, but the intensity of each projection has reduced by $a$ as well.

# 6 Problem 6