

## Drawing Portraits using Discrete Fourier Transform (DFT) and Epicycles

### Methodology:

#### 1. Canny edge detection:

##### Equations:

- Gaussian Smoothing:  $G(x, y) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$
- Gradient Magnitude:  $|\nabla f| = \sqrt{G_x^2 + G_y^2}$
- Gradient Direction:  $\theta = \arctan\left(\frac{G_y}{G_x}\right)$

#### 2. Contour Extraction

Contours obtained using OpenCV findContours function.  
Contour points reshaped into 1D arrays for processing.

#### 3. Fourier Coefficient Computation

Contour points represented as complex numbers.  
Time discretization from 0 to  $2\pi$   
Fourier coefficients computed using numerical integration.

#### 4. Epicycle Animation

Epicycles constructed using Fourier coefficients.  
Animation generated by updating epicycle positions iteratively.



Figure 4.1: Input image in gray-scaled mode

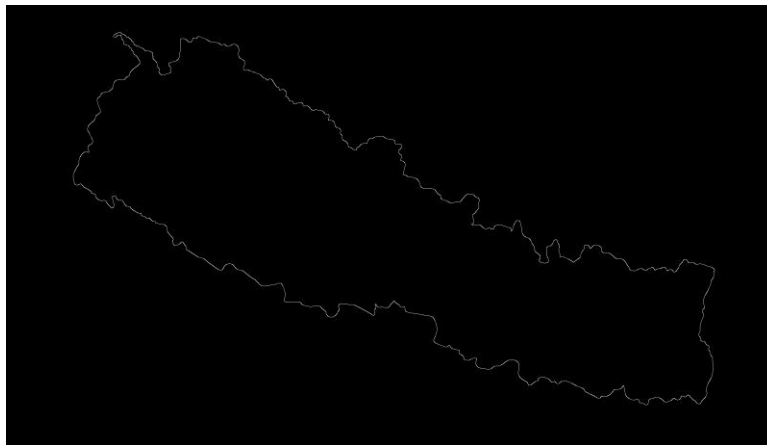


Figure 4.2: Image after extracting edges with points

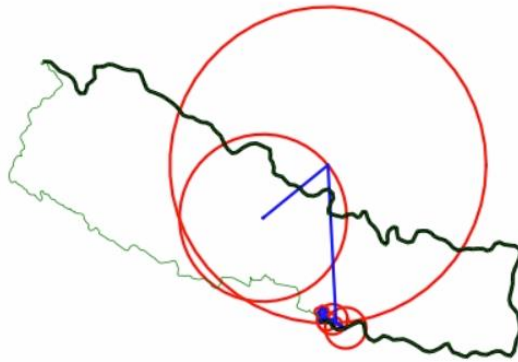


Figure 4.3: Final output drawing

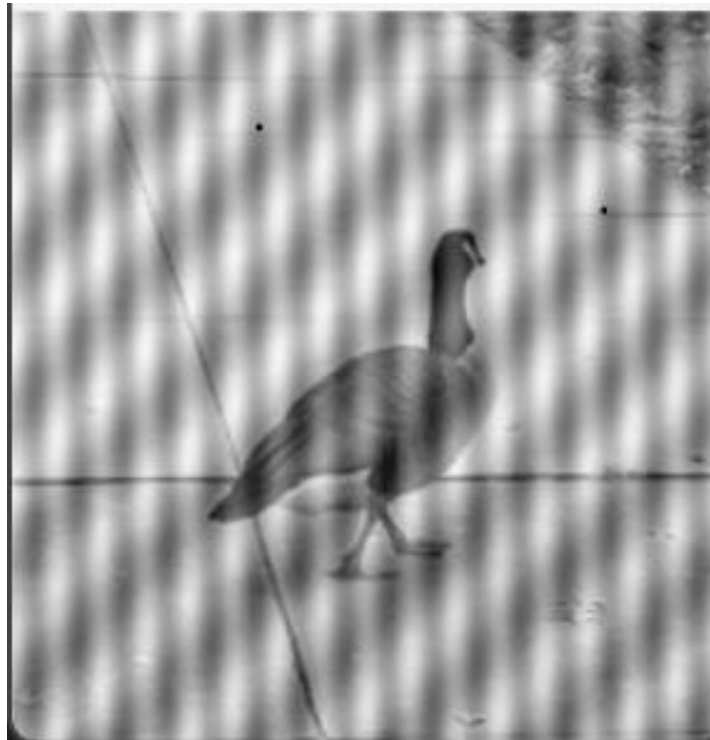


Figure 4.4: Input image



Figure 4.5: Notch filter

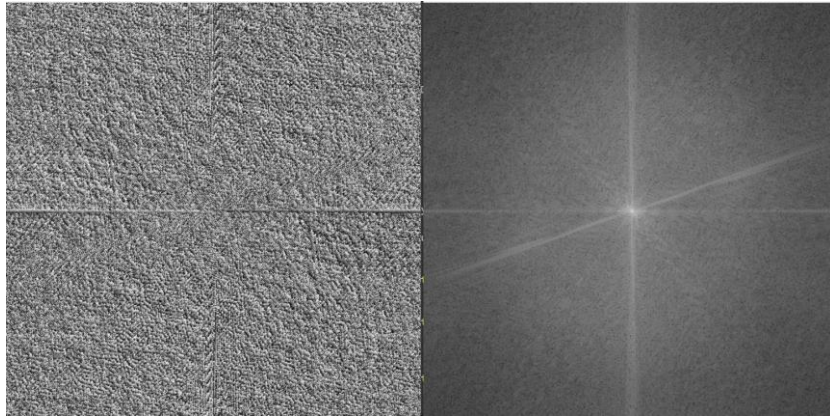


Figure 4.6: Phase (left) & Magnitude (right) spectrum



Figure 4.7 : Final output after noise removed

