

# Directional Quincunx Tight Wavelet Frames and Image Processing

## PROJECT DESCRIPTION

"Quincunx wavelets and framelets are always a fascinating topic in wavelet analysis due to their connections with fractals and applications to computer graphics and image processing. For example, the quincunx fan-shaped two-dimensional wavelet filters have been used in contourlets and shearlets to build directional representations for their superior performance in image/video processing. On the other hand, quincunx wavelets and framelets are theoretically and mathematically very interesting since many their desirable properties in both theory and applications.

In this project, we shall explore the possibility for constructing quincunx tight wavelet frames with directionality, for short, we call them directional quincunx tight framelets. In order to efficiently capture edge singularities in any two-dimensional problems such as image processing, tight framelets with directionality are very important. Currently there is a known fascinating family of quincunx tight framelets constructed from one-dimensional filters. To achieve our goal, we propose to further develop and study this technique to use one-dimensional filters to construct directional quincunx tight framelets. The goal is to find some quincunx tight framelets with directionality, short supports and some other desirable properties. If time permits, then we shall also experiment such directional quincunx tight framelets for the image denoising problem.

The student should have a strong background in mathematics, in particular, background in calculus and analysis. Some programming skill/knowledge (such as maple, mathematica, or matlab) is helpful. This project is also interested in considering students who are outside of mathematics but have a strong background in computer science or engineering with excellent programming skills and some experience in signal/image processing."

## FACULTY-DEPARTMENT

Sciences - Mathematical and Statistical Sciences

## DESIRED FIELD OF (STUDENT) STUDY

Mathematics or computer science or engineering

## INTERNSHIP LOCATION

University of Alberta Main Campus - Edmonton

## NUMBER OF INTERNSHIP POSITIONS

2

Contact: Brendan Cavanagh, Internship Coordinator (Inbound)  
University of Alberta International  
intern@ualberta.ca

INTERNSHIP START DATE

Flexible

INTERNSHIP END DATE

Flexible

ARE THE DATES FLEXIBLE?

Yes, I am flexible regarding the internship dates. Selected students can contact me to request a date change.