

# Thesis Chapter Plan

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# 1 Introduction

- Message of the Thesis
- Need for Dynamic spectrum management
- Chapter introduction

# 2 Spectrum Sensing

## 2.1 Nyquist Approaches

- Nyquist Theorem as convolution with fence post function

## 2.2 Compressive Sensing

- Comparison with Source coding: why are we collecting all this extra data?
- Can we collect less?
- This requires undersampling (relative to the number of Nyquist samples)
- Leads to three questions 1 - How to obtain samples, 2 - how to reconstruct the signal, 3 - How to perform inference on samples
- Signals which we can compress are sparse - some examples
- Instead of measuring sparse coefficients measure correlations between signal and some other basis
- Incoherence
- Restricted Isometry Property
- Reconstruction: solve a linear program/do Bayesian inference.
- Example: single pixel camera

## **2.3 Architectures for Compressive Spectrum Sensing**

### **2.3.1 Random Demodulator**

### **2.3.2 Modulated Wideband Converter**

## **3 Convex Optimisation**

### **3.1 ADMM**

### **3.2 The Proximity Operator**

#### **3.2.1 Properties**

#### **3.2.2 Motivation**

#### **3.2.3 Examples**

## **4 Distributed Spectrum Sensing**

- Why distributed sensing?
- Greedy vs Convex methods
- Why Convex Methods

### **4.1 Sensing Models**

- Frequency Only vs Joint Frequency and Space

### **4.2 Constrained Optimisation on Graphs**

## **5 New Basis**

### **5.1 Edge Detection**

## **6 Compressive Inference**

- What problem are we solving?
- We can

## **7 Numerical Results**

## **8 Group Testing**

## **9 Conclusions**