

# Direction of arrival estimation of multiple signal sources using single-bit quantization

## Introduction

Estimating the direction of arrival (DoA) of a propagating electromagnetic wave is a common problem in a variety of applications. It is often achieved by employing an antenna array that comprises multiple antenna elements separated in space by a fraction of the wavelength, as shown in Fig. 1. The signal received by each antenna is amplified, down converted to some intermediate frequency, and passed to the analog to digital converter (ADC) for digitization. The phase difference between the signals obtained from the individual antennas is then used to estimate the DoAs of the source signals impinging on the array. It has been recently demonstrated that one can significantly reduce the hardware and computational complexity of DoA estimation by reducing the resolution of the ADCs to a single bit without significantly degrading estimation performance.

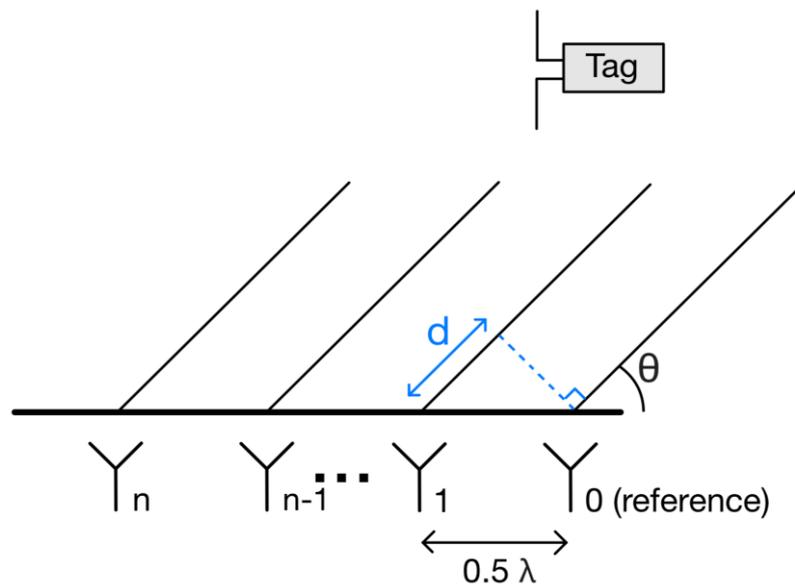


Fig. 1 DoA estimation using a uniform linear array

## Project description

In this project, we investigate the use of single-bit quantization for DoA estimation. Particularly, we focus on the performance of common DoA estimation algorithms (e.g., traditional beamforming, MUSIC, CS-based methods) when applied to single-bit quantized data. Since quantization is a nonlinear operation, it can introduce unwanted artifacts, especially when multiple signal sources are present. Therefore, the goal of this project is to investigate the effects arising from single-bit quantization and how they can be mitigated.

**Requirements:** You are a motivated student looking for a final project in the field of signal processing and estimation theory. You have good knowledge in signal processing and strong experience with Matlab.

For more details, contact **Dr. A. Lavrenko** [a.lavrenko@utwente.nl](mailto:a.lavrenko@utwente.nl) at UT.