

Recently, rapid development has been made in locating and targeting moving tumors. In practical treatment systems, latency induced by information acquisition, processing, communication and hardware control could significantly affect the targeting accuracy based on observed tumor locations. This talk focuses on introducing state-of-the-art methods in target location prediction, and discussing the logical connections and differences among these methods. We will first make the principle distinction between the deterministic and stochastic perspectives.

For the deterministic setup, we will discuss the development in system representation, in terms of basis functions (such as Fourier and wavelet), and choice between parametric regression model (e.g., adaptive ARMA) and the nonparametric options, such as artificial neural networks and support vector machines. The less conventional stochastic perspective will be motivated by honoring a statistical interpretation of the familiar Kalman filter. Then a novel kernel density estimation based prediction approach will be introduced, which utilizes nonparametric probability learning techniques. Useful techniques such as state augmentation, and unified treatment for multi-dimensional data will be covered. Some recent progress and unpublished results will be presented.

Learning objectives:

- (1) To systematically present the state-of-the-art prediction algorithms
- (2) To discuss and analyze the connections among various developments
- (3) To address the practical considerations in selecting prediction methods for various types of target motions and system configurations.