

## Abstract

This work addresses the problem of stochastic state estimation for hybrid Markovian switching systems. The proposed Multiple Hypotheses Mixing Filter (MHMF) combines the Generalized Pseudo Bayes' (GPB) multiple hypotheses tracking with the Interacting Multiple Model's (IMM) estimates mixing in order to improve performance, the later being a particular case of the MHMF. A hypotheses pruning step prevents the filter's output to be degraded by estimates coming from very unlikely hypotheses and the mode transition probabilities are estimated online based on the measurements' likelihoods.

## Object of Study

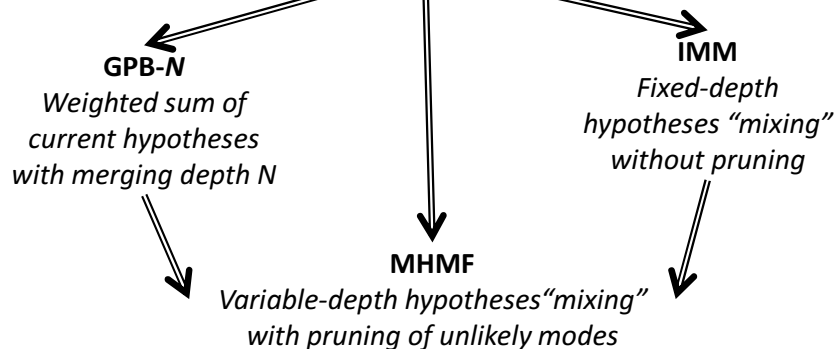
Discrete time hybrid system

$$x_k = f_{m_k}(x_{k-1}, u_{k-1}, w_{k-1})$$

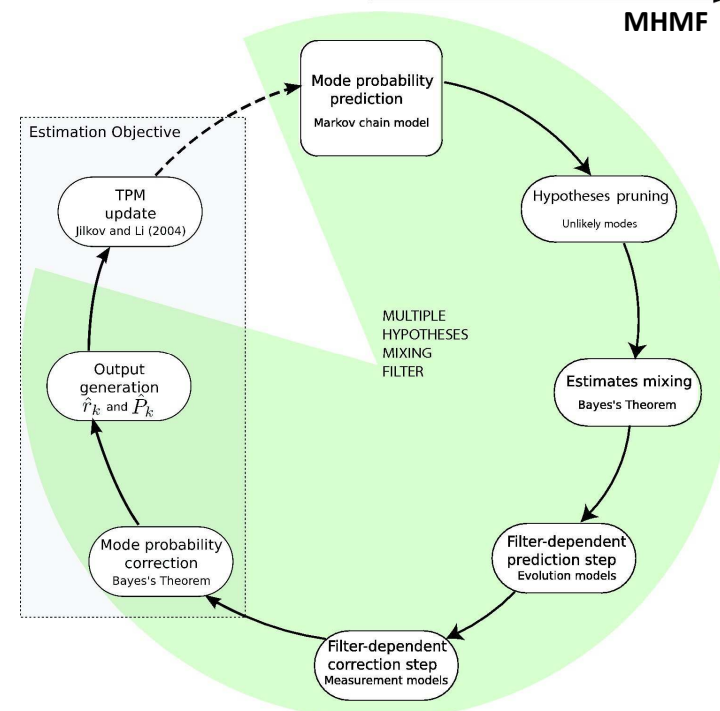
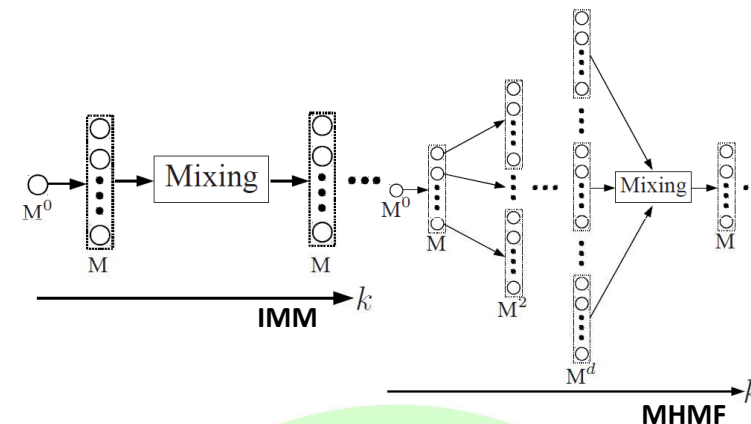
$$y_k = h_{m_k}(x_k, v_k), k \in \mathbb{N}$$

$m_k$  : system's discrete mode  $\rightarrow$  Markov Chain with  $M$  possible values

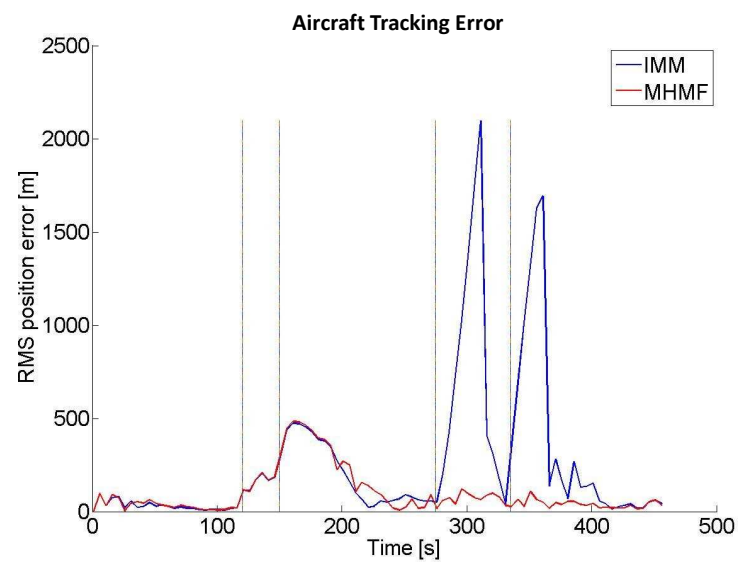
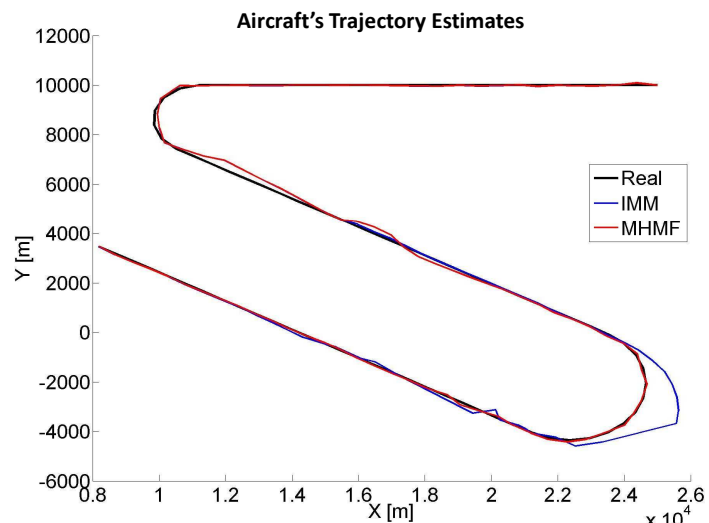
Number of hypotheses grows exponentially with time!



## MHMF Overview



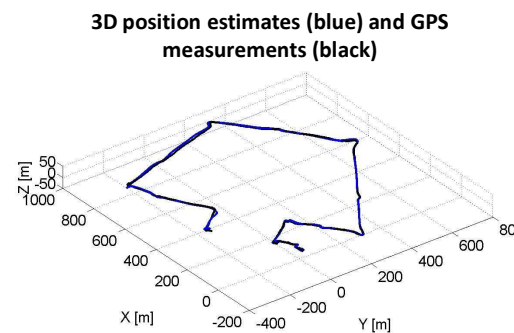
## Application I: Air Traffic Control System



## Application II: Navigation and 3D Localization under Sensor Faults



Route in Darcy Ribeiro campus (Source: Google Earth, 15°45'49.40''S and 47°52'07.61''W, Brasilia, Brazil. Imagery date: 10/07/2008).



**Mean number of hypotheses**

IMM	MHMF
2	1.0626

