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GEO 585.01: System Identification and Estimation in Geosciences

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GEO585: System identification and estimation in Geosciences
Spring 2013
University of Montana
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Class meetings: Monday-Wednesday 10:10am-11:30am

Overarching goals: In this course we will explore the theoretical basis and the use of techniques for system identification and estimation with application in the geosciences. This includes

- Function approximation using support vector machines and artificial neural networks.

- Correction using bayesian conditioning and Kalman filters

- Application to non-linear multi-objective optimization

Ancillary goals: This is a seminar style course. The bulk of the learning will be done through discussion of papers and on practical applications of the techniques discussed using computer models

Prerequisites: Interest in quantitative modeling of environmental processes along with comfort with computers, calculus, physics and algebra.

Office hours: Office hours will be the next hour after class.

Grades: Based on class discussion, understanding of reading assignments and final project presentation.

	Topics	Notes
Week 1	Motivation. Review of topics	Reading 1
	Probability, random variables	
	Normal distribution, white noise	
	least square estimation	
Week 2	System representation	Reading 2
	Physics-based and black box models	
Week 3-4	Estimation	
	Average and MA filter	
	Low pass filter	
	Linear Kalman Filter	
	Extended and unscented Kalman Filter	
	Ensemble Kalman Filter	Reading 3
Week 5-6	Representation	
	Support Vector Machines	Reading 4
	Artificial Neural Networks	
Week 7-15	Application of represented systems	
	Model surrogate for estimation	Reading 5
	Multi-objective optimization	Reading 6