CIS6930 Mathematics for Intelligent Systems II Spring 2009

Home Work Assignment 2: Due Thursday 03/05/09 before class

1. Prove that the second variation (i.e., the second differential) of a twice differentiable functional is unique.
2. Show that the hyperbolic set $\{x \in \mathbb{R}^n_+ | \prod_{i=1}^n x_i \geq 1\}$ is *convex*.
3. If $f : \mathbb{R}^n \to \mathbb{R}$, then the *perspective* of f is the function $g : \mathbb{R}^{n+1} \to \mathbb{R}$ defined by $g(x,t) = tf(x/t)$, with the domain $\mathbf{dom}\ g = \{(x,t)|x/t \in \mathbf{dom}\ f, t > 0\}$. Prove that if f is a convex function so is g.
4. Write the dual formulation for the SVM with slack variables discussed in class.
5. Prove that if $K(x,y)$ is a valid kernel function then so is $(K(x,y))^2$.