Notes on Optimal Approximations by Piecewise Smooth Functions and Associated Variational Problems

compiled by D. Gueorguiev , 10/19/2024

# Introduction and Problem Outline

Three variational problems with application to Computer Vision will be discussed in this document.

A fundamental problem in computer vision is to appropriately decompose the domain of a function of two variables. Assume that a 3D world is observed by an eye or a camera from some point and that represents the intensity of the light in this world approaching from direction . If one has a lens at focusing this light on a retina or a film – in both cases a plane domain in which we may introduce coordinates – then let be the strength of the light signal striking at a point with coordinates : is essentially the same as , possibly after a simple transformation given by the geometry of the imaging system. The function defined on the plane domain will be called an *image*.

Analysis of the function

# References

[Optimal Approximations by Piecewise Smooth Functions and Associated Variational Problems, David Mumford, Jayant Shah, 1989](https://github.com/dimitarpg13/image_processing/blob/main/literature/articles/variational_methods/Optimal_Approximations_by_Piecewise_Smooth_Functions_and_Associated_Variational_Problems_1989-Mumford-Shah.pdf)

[The Bayesian Rationale for Energy Functionals, David Mumford, 1997](https://github.com/dimitarpg13/image_processing/blob/main/literature/articles/variational_methods/The_Bayesian_Rationale_for_Energy_Functionals_Mumford_1997.pdf)

[Introduction to Variational Methods for Graphical Models, Michael I. Jordan et al, UC Berkeley, 1999](https://github.com/dimitarpg13/image_processing/blob/main/literature/articles/variational_methods/Intro_to_Variatonal_Methods_for_Graphical_Models_Jordan_1999.pdf)