Computational vision, visual computing and biomedical image analysis have made tremendous progress in the past decade. This is mostly due the development of efficient learning and inference algorithms which allow better and richer modeling of visual perception tasks. Hyper-Graph representations are among the most prominent tools to address such perception through the casting of perception as a graph optimization problem. In this talk, we briefly introduce the interest of such representations, discuss their strength and limitations, provide appropriate strategies for their inference learning and present their application to address a variety of problems of visual computing.