# Sparse Feature Maps in a Scale Hierarchy

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### Introduction

This paper describes an essential step towards a view centred representation of the low-level structure in an image. The low-level structure (lines and edges) is separated into three sparse feature maps per scale. A value in one of the maps has a descriptive, and at the same time locally linear behaviour, making these maps ideal as input to a learning machinery.



#### Characteristic phase

The three maps in each scale correspond to local signal phases of 0,  $\pi$ , and  $\pm \pi/2$  respectively. The reason that these are chosen is that they are spatially stable over scale, and thus characterize the local image region.



By requiring that a line event is present in two neighbouring scales, one octave apart, and requiring that there is no edge response in the second lower octave, we are able to eliminate the ringings in the response, and produce a sparse output.

## Lines and edges in scale space

The resultant representation exhibits a smooth transition between line and edge description of events.



Since images can be successfully approximated as locally onedimensional, this line of reasoning can be extended to 2D.



The locally dominant orientation is represented in the maps as a complex argument. The colour represents this argument, and the intensity represents the magnitude.

Image	0 Phase bright lines	$\pi$ Phase dark lines	$\pm \pi/2$ Phase edges
		No responses	

#### Scale hierarchy of a natural image

