

# System and Methods of Amplitude-Modulation Frequency-Modulation (AM-FM) Demodulation for Image and Video Processing

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## Technology description

### Background

Noninvasive, digital imaging is a multi-billion dollar industry with many applications and is ubiquitous to our culture. It is used in the medical field as a diagnostic tool, in ultrasound, magnetic resonance imaging (MRI) and retinal image characterization. However, digital imaging is also prevalent in such diverse areas as homeland security, nanoscience research, and the film industry to name but a few. In most contexts and applications, though, image quality defines the value of the tool. The better the picture or image quality, the more valuable the tool. However, with digital images and videos, comes the possibility of extracting more information than just an image. In mammography, for example, an image might reveal an abnormality yet not be able to “tell” the physician whether it is cancer or not. In such a case, further testing is required to determine the presence or absence of cancer. A method to reprocess the image or video to increase the selectivity would be invaluable to more accurate screening for cancer and other situations with specific morphologic or dynamic characteristics. Such a method would have wider implications in enabling not only better cancer screening, but also target identification, motion tracking, activity identification, and possibly drug and explosives detection.

### Technology Description

A method has been developed to represent image content for image analysis purposes. The method includes efficient and robust Amplitude-Modulation Frequency-Modulation (AM-FM) algorithms for representing 2D and 3D signals. It also includes image and video classification algorithms based on AM-FM features, such as 2D/3D signal analysis, 2D/3D reconstructions, 2D/3D signal classification, motion estimation and activity recognition in videos. Additionally, the method includes an efficient formulation of a variable spacing, local linear phase method (VS-LLP) for instantaneous frequency (IF) estimation. Said method has demonstrated preliminary success in the potential to identify retinal abnormalities, predict plaque rupture in atherosclerosis, texture analysis in medical images, and discriminate between peaceful and violent human activity.

## Publications

[Multiscale directional AM-FM demodulation of images using a 2D optimized method](#)

[Multiscale AM-FM Demodulation and Image Reconstruction Methods With Improved Accuracy](#)

[Recent multiscale AM-FM methods in emerging applications in medical imaging](#)

[Robust Multiscale AM-FM Demodulation of Digital Images](#)

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## Application area

Method for reprocessing digital images and videos to provide more information than humanly discerned

Applicable to the imaging groups of standard color (RGB), ultrasound, radiography, computer tomography (CT) image slice, magnetic resonance image (MRI), and functional MRI (f-MRI)

Efficient and robust Amplitude-Modulation Frequency-Modulation (AM-FM) algorithms for 2D and 3D still and video signals with multiple applications

Increases selectivity of image testing methods without sacrificing sensitivity

Nanoscience research such as characterization with electron microscopy

Security field applications such as object identification, fingerprint identification, human activity identification, and motion prediction

Quality assurance/nondestructive testing (such as equipment fatigue)

## Institution

[The University of New Mexico](#)

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