**摘　要**

論文名稱：從單張自然影像中去除高密度脈衝雜訊技術

頁數：60頁

校所別：國立臺北科技大學電子工程研究所

畢業時間：一百零九學年度 第一學期

學位：博士

研究生：林柏雄

指導教授：黃士嘉 博士

關鍵詞：脈衝雜訊、形態學影像處理、深度學習

消除脈衝雜訊是影像處理系統中至關重要的步驟，近年來已經提出許多消除雜訊的方法來改善影像品質，然而消除高密度的脈衝雜訊仍然是主要挑戰之一。在本文中，為了解決高密度雜訊相關影像消除問題，我們提出了兩種新的消除雜訊方法，稱為形態均值濾波器(morphological mean filter)和輕型消除雜訊網絡(LD-Net)。形態均值濾波器分為兩個階段執行，包括無雜訊像素計數器（noise-free pixel counter : NPC）模組和形態學像素擴散（morphological pixel dilation : MPD）模組，首先提出的方法是檢測影像中無雜訊像素的數量和位置，接下來以形態影像處理的方式將無雜訊像素為基礎進行迭代來向周圍擴張，並替換相鄰的雜訊像素直到收斂為止，通過這樣的步驟能夠去除高密度雜訊。LD-Net分兩個階段執行，其中包括特徵增強(feature augmentation : FA)階段和特徵細化(feature refinement : FR)階段，在特徵增強階段使用反捲積層增加輸入影像的空間大小和尺寸進行有效的特徵學習，在特徵細化階段利用卷積層的序列增強圖像的紋理細節來重建無雜訊影像，實驗結果表明，與其他去雜訊方法相比，該方法能更有效地去除損壞影像中的高密度脈衝雜訊。

**Abstract**

Title: Removing High-density Impulse Noises from a Single Natural Image

Pages: 60

School: National Taipei University of Technology

Department: Electronic Engineering

Time: December, 2020

Degree: Ph.D.

Researcher: Po-Hsiung Lin

Advisor: Shih-Chia Huang Ph.D.

Keywords: Impulse Noise, Morphological Image Processing, Deep Learning.

The removal of impulse noise is a crucial pre-processing step in image processing systems. In recent years, numerous noise-removal methods have been proposed to improve denoizing performance and reconstruct noise-free images. However, removing high-density impulse noise remains a major challenge. In this thesis, to address the image denoizing problem associated with high-density noise, we propose two new denoizing methods, called morphological mean filter(M-MF) and Lightweight Denoising network(LD-Net).M-MF is performed in two modules including a noise-free pixel counter (NPC) module and a morphological pixel dilation (MPD) module. First, the proposed method detects both the number and position of the noise-free pixels in the image. Next, the dilatation operation of the noise-free pixels based on morphological image processing is iteratively executed to replace the neighbor noise pixels until convergence. By doing so, the proposed method is capable to remove high-density noise and therefore reconstruct the noise-free image. LD-Net is performed in two stages including a feature augmentation stage(FA) and a feature refinement stage(FR). During the feature augmentation stage, the spatial size and dimension of the input image are increased by employing the deconvolutional layers for effective feature learning. During the feature refinement stage, the textural details of the image are enhanced for the reconstruction of the noise-free image by the utilization of a proposed sequence of three convolutional layers. Experimental results indicate that the proposed method more effectively removes high-density impulse noise in corrupted images in comparison with the other tested state-of-the-art methods.