Demosaic 系列五：AI

显然 AI 是有用的，但是显然 AI 是过于复杂的。

一、NAT

Color Demosaicking by Local Directional Interpolation and Nonlocal Adaptive Thresholding, Unknown 2011，Lei Zhang，香港理工大学

引用次数为 507（截至 2024.02）。张磊博士的文章，引用次数很高，效果也还行，但是因为是非线性所以时间上感觉会长很多，所以实用价值存疑。

本质思想就是用 NLM 的方法去解决 Demosaic，貌似也是先算色差，然后在色差图上去求解。

二、ECC

EXPLOITATION OF INTER-COLOR CORRELATION FOR COLOR IMAGE, ICIP 2013, Jaiswal，*HK UST*

引用次数 14（2024.02），论文太花里胡哨了，本质上就是融合【利用低通滤波预测】和【利用色差插值预测】这两种方法。

论文就是用了许多公式，最后结果就是融合两种方法效果会更好，但是他用的这两个方法都是最朴素的方法，后续许多改进方法，可能论文的公式就不适用了。

此外论文和 RI 方法一样，只是对 R 和 B 进行提升，G 是认为 GBTF 预测的 G 足够准确。

3.4. Algorithm steps

The main steps of the algorithm are as follows:

1. Interpolate the green component ($\hat{G}$) first by some interpolation process. In our experiment we propose to use method [9] to get the $\hat{G}$ component.
2. To interpolate the missing samples of a block ($\hat{r}$) in red component, its corresponding $\hat{r}_{CDI}$ and $\hat{r}_{LPF}$ are computed.
3. Due to unavailability of original block (r), we use the resultant image ($\grave{r}$) obtained by the method [9] as an estimation of original block (r). Thus the weighted parameters (w_1, w_2) can be calculated from (17). Using the weighted parameters, $\hat{r}$ can be estimated from (14).
4. Repeat step 2 and step 3 to reconstruct the whole image.

$$d = r - \hat{r} = r - (w_1 \hat{r}_{LPF} + w_2 \hat{r}_{CDI}) = w_1 d_{LPF} + w_2 d_{CDI} \tag{15}$$

$$\begin{cases} w_1 = E[d_{CDI}(d_{CDI} - d_{LPF})]/E[(d_{CDI} - d_{LPF})^2], \\ w_2 = E[d_{LPF}(d_{LPF} - d_{CDI})]/E[(d_{CDI} - d_{LPF})^2] \end{cases}$$

$$\hat{r} = w_1 \hat{r}_{LPF} + w_2 \hat{r}_{CDI}$$

The simplest way to demosaicking is to apply low pass filter to each channel independently. Using the same LPF (as used in (2)), the interpolated red component ($\hat{R}_{LPF}$) is given by

$$\hat{R}_{LPF} = \zeta\{R_a\} = R_l \tag{4}$$

As discussed in previous section, the interpolated $\hat{R}_{CDI}$ from (3) can be written as:

$$\hat{R}_{CDI} = R_l - \hat{G}_l + \hat{G} = R_l + \hat{G}_h \tag{7}$$