Fully Deep Blind Image Quality Predictor

Guozemin
2018.04.11

IEEE Journal of Selected Topics in Signal Processing (JSTSP), 2017.

- **Introduction**
- **The facing problems**
- **Methods**
- **Framework**

Introduction

- RN-IQA

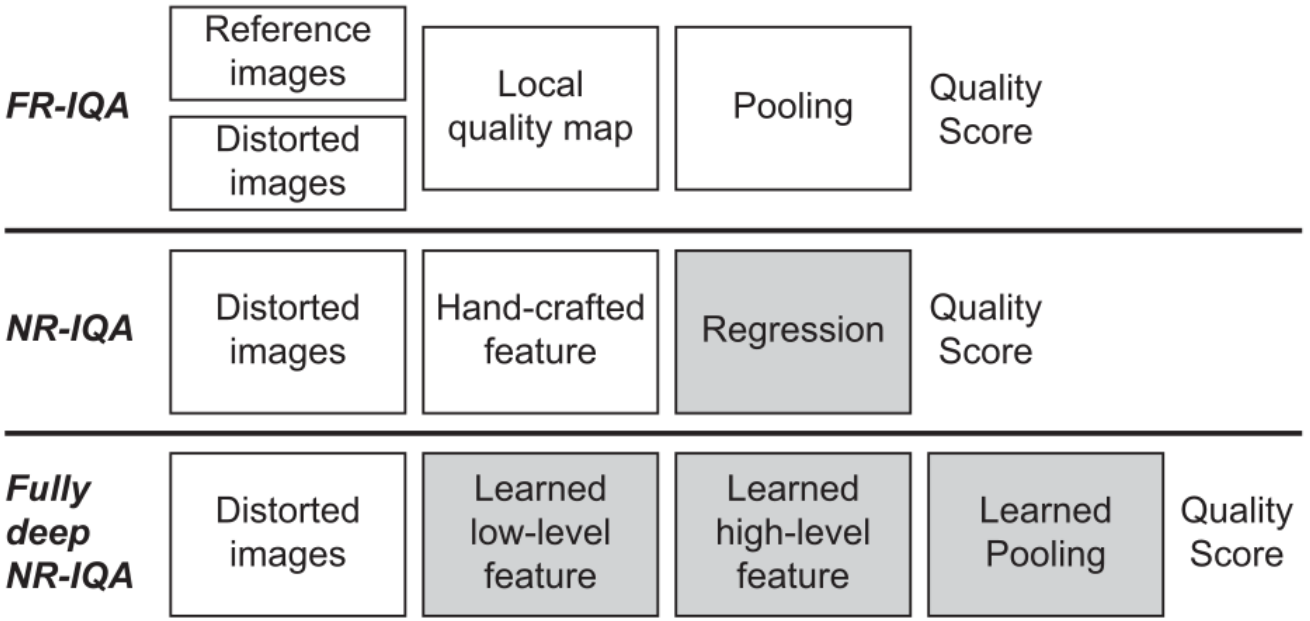

Fig. 1. Flow chart comparison of FR-IQA, NR-IQA, and fully deep NR-IQA. Gray boxes indicate learned processes.

The facing problems

- Lack of Training Data
- Absence of Local Ground Truth Targets
- Different Purposes of Feature Learning

Methods

- Patch-based method
- FR-IQA metrics
- A deep-learning-based NR-IQA

Framework

- BIECON

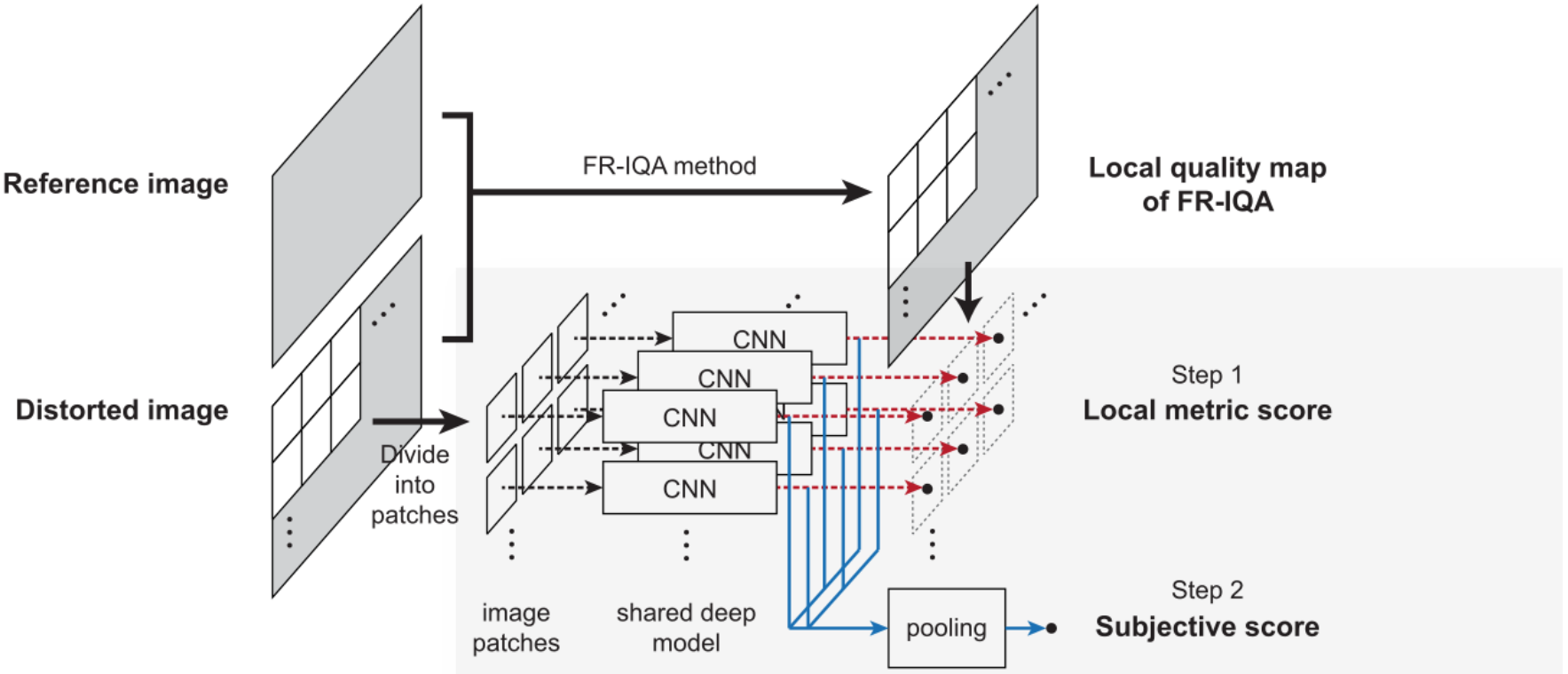

Fig. 2. Overall training process of proposed NR-IQA framework. Step 1: CNN model is regressed onto local metric score derived using FR-IQA metric. Step 2: pooled features are regressed onto subjective score.

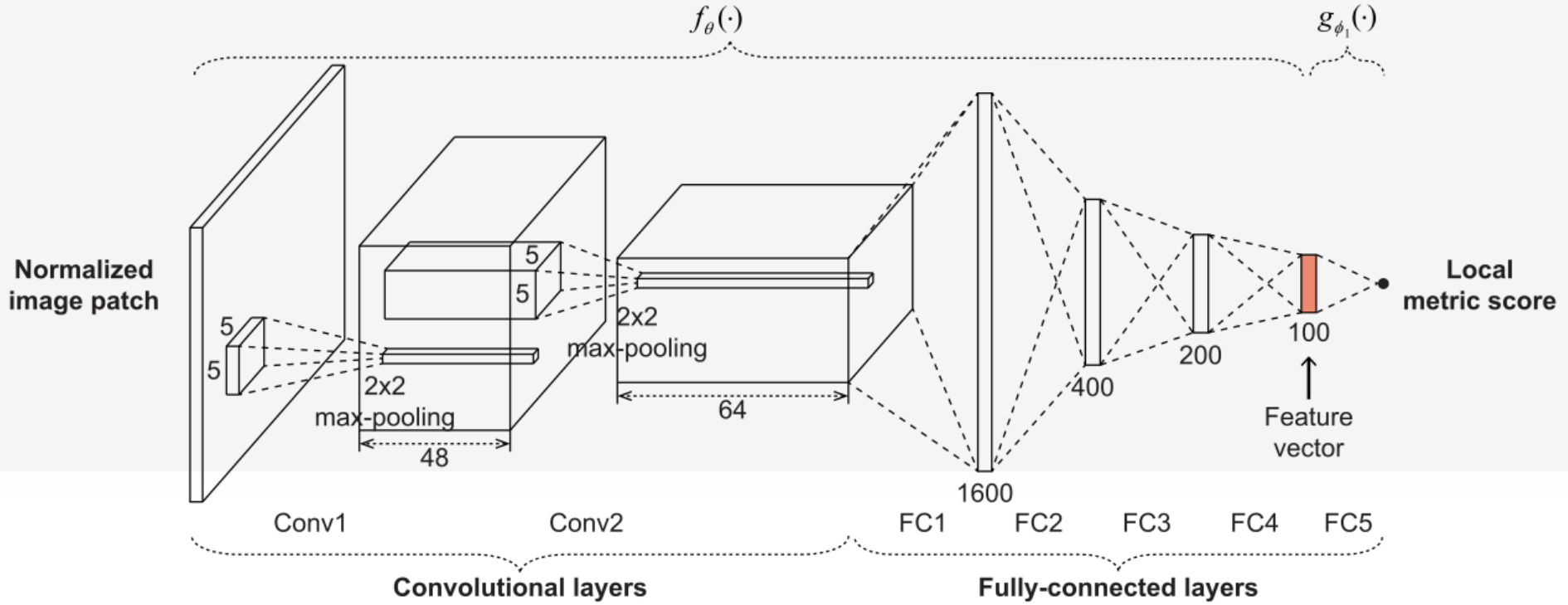

Fig. 3. Architecture of CNN-based local metric score training model.

- Image Normalization

$$I'(i,j) = \frac{I(i,j) - \mu(i,j)}{\sigma(i,j) + C} \tag{1}$$

$$\mu(i,j) = \sum_{i'j'} \omega_{i'j'} I_{i'j'}(i,j) \tag{2}$$

$$\sigma(i,j) = \sqrt{\sum_{i'j'} \omega_{i'j'} (I_{i'j'}(i,j) - \mu(i,j))^2} \tag{3}$$

- Local Metric Score Regression

$$M_{FSIM_C}(i,j) = \frac{S_{PC}(i,j) S_G(i,j) (S_C(i,j))^{\lambda} PC_m(i,j)}{1/HW \cdot \sum_{i=1}^{H} \sum_{j=1}^{W} PC_m(i,j)} \tag{4}$$

$$M_{VSI}(i,j) = \frac{S_{VS}(i,j) (S_G(i,j))^{\alpha} (S_C(i,j))^{\beta} VS_m(i,j)}{1/HW \cdot \sum_{i=1}^{H} \sum_{j=1}^{W} VS_m(i,j)}. \tag{5}$$

$$s_n = \frac{1}{32 \cdot 32} \sum_{i,j \in \mathbf{p}_n} M_{metric}(i,j) \tag{6}$$

$$M_{metric}\,(metric \in \{SSIM, GMS, FSIM_C, VSI\})$$

- Loss:

$$\mathcal{L}_1(\mathbf{p}_n, s_n; \theta, \phi_1) = \frac{1}{N} \sum_{n=1}^{N} \left\| g_{\phi_1}(f_\theta(\mathbf{p}_n)) - s_n \right\|_F^2. \tag{7}$$

Result

TABLE I
SROCC COMPARISON ON THE LIVE IQA DATABASE

Metrics	JP2K	JPEG	WN	BLUR	FF	ALL
PSNR	0.895	0.881	0.985	0.782	0.891	0.876
SSIM	0.961	0.972	0.969	0.952	**0.956**	0.948
GMSD	0.968	0.973	0.974	0.957	0.942	0.958
FSIMc	**0.972**	**0.979**	0.971	**0.968**	0.950	**0.963**
VSI	0.960	0.973	**0.984**	0.951	0.943	0.951
BLIINDS II	0.932	0.933	0.946	0.891	0.852	0.912
DIIVINE	0.912	0.921	**0.982**	0.937	0.869	0.925
BRISQUE	0.914	0.965	0.977	0.951	0.877	0.939
NIQE	0.917	0.938	0.967	0.934	0.859	0.914
BIECON	**0.952**	**0.974**	0.980	**0.956**	**0.923**	**0.961**

TABLE II
LCC COMPARISON ON THE LIVE IQA DATABASE

Metrics	JP2K	JPEG	WN	BLUR	FF	ALL
PSNR	0.876	0.903	0.917	0.780	0.880	0.872
SSIM	0.941	0.946	**0.982**	0.900	**0.951**	0.945
GMSD	**0.963**	0.979	0.977	0.954	0.939	0.956
FSIMc	0.910	**0.985**	0.976	**0.979**	0.922	**0.960**
VSI	0.914	0.967	0.981	0.965	0.915	0.948
BLIINDS II	0.939	0.943	0.964	0.899	0.879	0.916
DIIVINE	0.923	0.935	**0.987**	0.937	0.891	0.923
BRISQUE	0.923	0.973	0.985	0.951	0.903	0.942
NIQE	0.937	0.956	0.977	**0.952**	0.913	0.915
BIECON	**0.965**	**0.987**	0.970	0.945	**0.931**	**0.962**