

Background

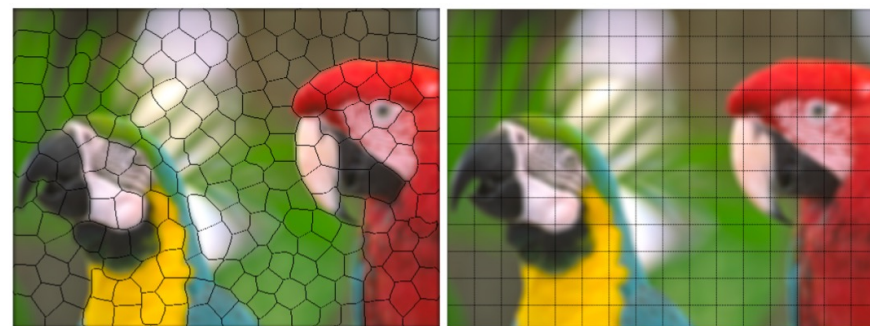
Image Quality Assessment (IQA): play an indispensable role in improving users' visual experience and optimizing the production line.
No-reference Image Quality Assessment (NR-IQA): objectively measure the input image quality in the absence of reference images.

Limitations of Local Modeling Method

1. Small-sized receptive field → Extracted features are **too local**.
2. Parameters fixed across the whole image → Contents are **equally treated**.
3. Lack of geometric and relational modeling → Missing **complex relations and layouts**.

Supersixel versus Square Patch

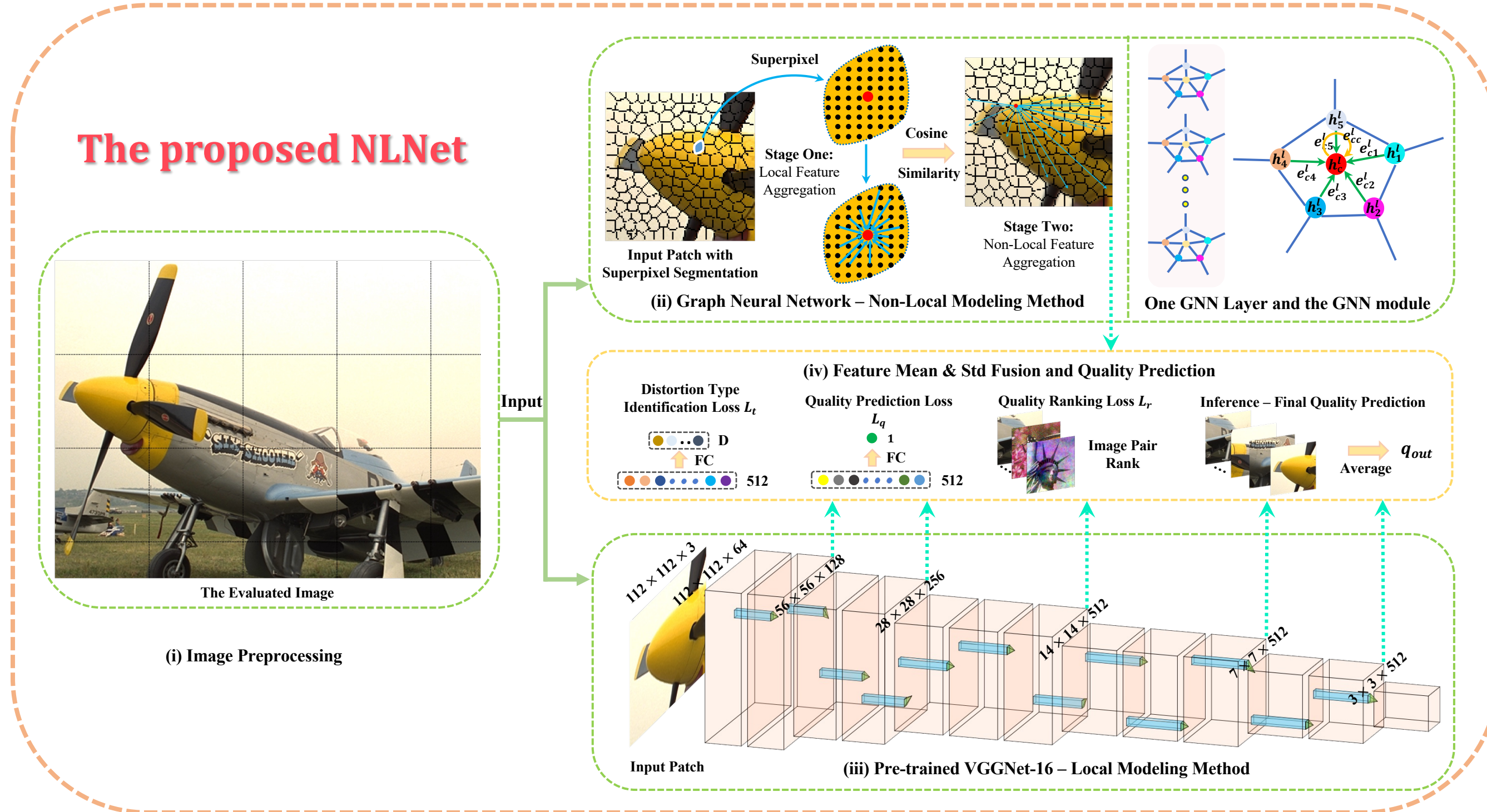
1. Adherence to boundaries and visually meaningful.
2. Accurate feature extraction.



(a) Supersixel segmentation (b) Square patch representation

Figure 1: The supersixel and square patch segmentation of the parrot image distorted by the Gaussian blur.

The proposed NLNet



Experimental Results

TABLE I
PERFORMANCE COMPARISONS ON THE LIVE, CSIQ, AND TID2013 DATABASES

Method	LIVE		CSIQ		TID2013	
	SRCC	PLCC	SRCC	PLCC	SRCC	PLCC
BRISQUE (2012) [3]	0.939	0.935	0.746	0.829	0.604	0.694
CORNIA (2012) [6]	0.947	0.950	0.678	0.776	0.678	0.768
M3 (2015) [40]	0.951	0.950	0.795	0.839	0.689	0.771
HOSA (2016) [7]	0.946	0.947	0.741	0.823	0.735	0.815
FRIQUEE (2017) [41]	0.940	0.944	0.835	0.874	0.68	0.753
DIQaM-NR (2018) [42]	0.960	0.972	-	-	0.835	0.855
DB-CNN (2020) [11]	0.968	0.971	0.946	0.959	0.816	0.865
HyperIQA (2020) [12]	0.962	0.966	0.923	0.942	0.729	0.775
GraphIQA (2022) [14]	0.968	0.970	0.920	0.938	-	-
TReS (2022) [15]	0.969	0.968	0.922	0.942	0.863	0.883
NLNet (Proposed)	0.962	0.963	0.941	0.958	0.856	0.880

TABLE II
CROSS-DATABASE PERFORMANCE COMPARISONS

Training Testing	LIVE		CSIQ		TID2013	
	CSIQ	TID2013	LIVE	TID2013	LIVE	CSIQ
BRISQUE (2012) [3]	0.562	0.358	0.847	0.454	0.790	0.590
CORNIA (2012) [6]	0.649	0.360	0.853	0.312	0.846	0.672
M3 (2015) [40]	0.621	0.344	0.797	0.328	0.873	0.605
HOSA (2016) [7]	0.594	0.361	0.773	0.329	0.846	0.612
FRIQUEE (2017) [41]	0.722	0.461	0.879	0.463	0.755	0.635
DIQaM-NR (2018) [42]	0.681	0.392	-	-	-	0.717
DB-CNN (2020) [11]	0.758	0.524	0.877	0.540	0.891	0.807
HyperIQA (2020) [12]	0.697	0.538	0.905	0.554	0.839	0.543
NLNet (Proposed)	0.771	0.497	0.923	0.516	0.895	0.730

Motivation

1. Human Visual System (HVS) is **adaptive to the local content** → Local appearance artifacts affect the overall quality.
2. HVS perceives image quality with **long-dependency** constructed among different regions → Non-local feature extraction for long-range dependency modeling.



(a) Local feature extraction is critical (b) Non-local dependency learned by the NLNet

Figure 2: Local region feature extraction and non-local dependency feature extraction

Conclusion

1. We propose a novel NR-IQA framework based on the GNN. The non-local behavior of natural images is emphasized and learned in our proposed **Non-Local Dependency Network** (termed as NLNet).
2. Extensive experimental results reveal that the proposed NLNet manages to extract the non-local information for quality prediction, and the superior performance in cross-dataset settings verifies the high generalization capability of our proposed method.