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Supplementary Materials: High resolution neural texture synthesis with long range constraints

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1 Perceptual evaluation of texture synthesis methods

1.1 Perceptual evaluation methodology

We here give some additional information on the protocol used to perform the perceptual evaluation. For each couple of methods (out of five) and each image, we build up two setups corresponding to the two possible positions of each method (right and left) to avoid a possible lateral bias. This results in 400 different questions, for which we got 3170 answers at each scale. Each question aims at comparing two methods on a given texture.

For each question four images are presented, corresponding to the two methods at two different scales (global and local). For each of the two scales, methods are compared by the user and answers are treated separately for each scale. This survey has been made with PsyToolkit servers [**?**,**?**].

It should be noted that asking a question such as ”which result is most similar to the reference” is not trivial. Users were indicated that by ”the most similar”, it should be understood ”which gives the most similar visual impression” and that images are not expected to correspond pixel by pixel. Ideally, a synthesized image should give the impression to correspond to a different region of the same material as the reference.

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1.2 Bradley-Terry model

Let $\beta_i \in \mathbb{R}$ represent the strength of method i (also called performance score), and let the outcome of a duel between methods i and j be determined by $\beta_i - \beta_j$. The Bradley-Terry model treats these outcomes as independent Bernoulli random variables with parameter p_{ij}, where the log-odds corresponding to the probability p_{ij} that method i beats method j is modeled as :

$$\log \frac{p_{ij}}{1-p_{ij}} = \beta_i - \beta_j \tag{1.1}$$

Equivalently, solving for p_{ij} yields

$$p_{ij} = \frac{e^{\beta_i - \beta_j}}{1+e^{\beta_i - \beta_j}} = \frac{e^{\beta_i}}{e^{\beta_i}+e^{\beta_j}} \tag{1.2}$$

This model is over-parameterized in the sense that it is exactly the same if we add a fixed constant to all values . It assigns scores to a fixed set of items based on pairwise comparisons between these items, where the log-odds of item "beating" item is given by the difference of their scores. The strength is estimated by second order optimization of the maximum likelihood and the standard deviation of the difference is approximated with the Hessian of this likelihood.

1.3 Winning probability

An alternative evaluation consists in calculating the probability that a method i is chosen among all candidates. This "winning probability" $W_i$is given by the average over j of the probability p_{ij} that a participant chooses the candidate i over j:

$$W_i = \frac{1}{N-1}\sum_{j\neq i}^{N} p_{ij} = \frac{1}{N-1}\sum_{j\neq i}^{N} \frac{e^{\beta_i - \beta_j}}{1+e^{\beta_i - \beta_j}} \tag{1.3}$$

We can estimate the standard error of W_i as :

$$\Sigma_i = \frac{1}{N-1}\sqrt{\sum_{j\neq i}^{N} \hat{\sigma}_{ij}^2} \tag{1.4}$$

under the hypothesis that the p_{ij} are independent.

2 More comparison with existing methods

In Figures 1.1 to 1.4 and 1.6 to 1.14, one can see the results of the different texture synthesize methods mentioned in section 4.

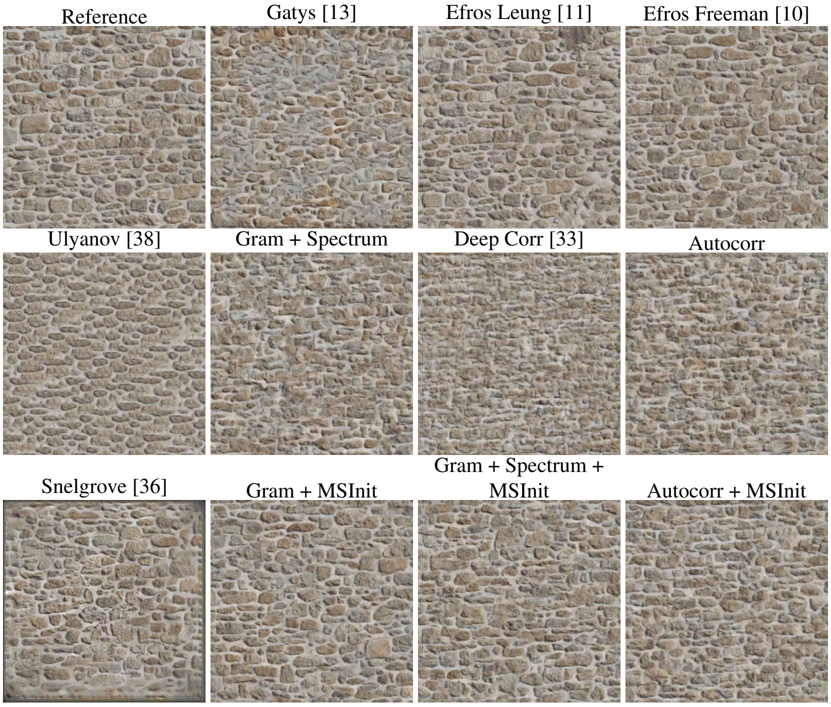

Fig. 2.1 Synthesis results using different methods for one given reference of size 1048×1048.

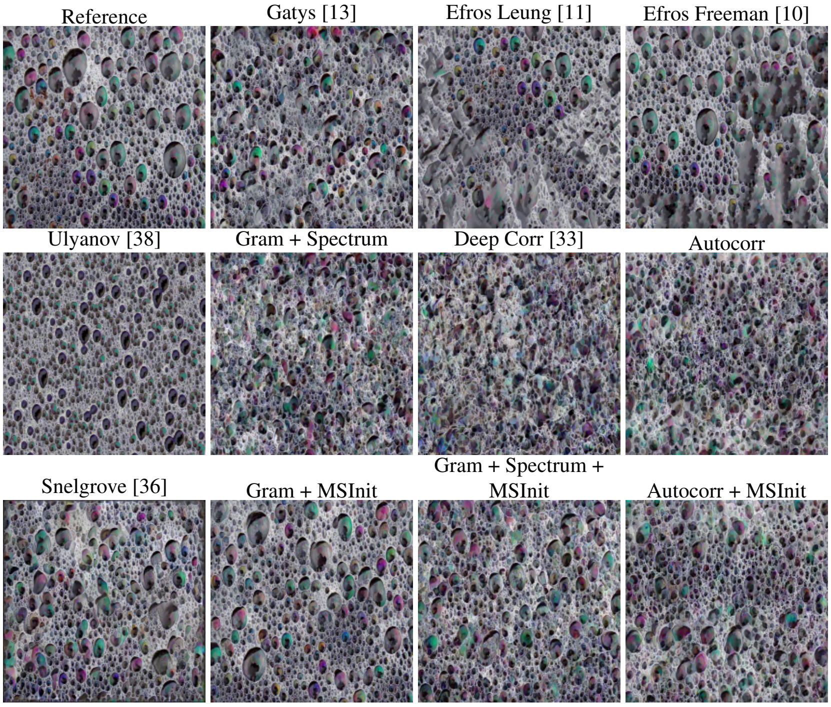

Fig. 2.2 Synthesis results using different methods for one given reference of size 1048×1048.

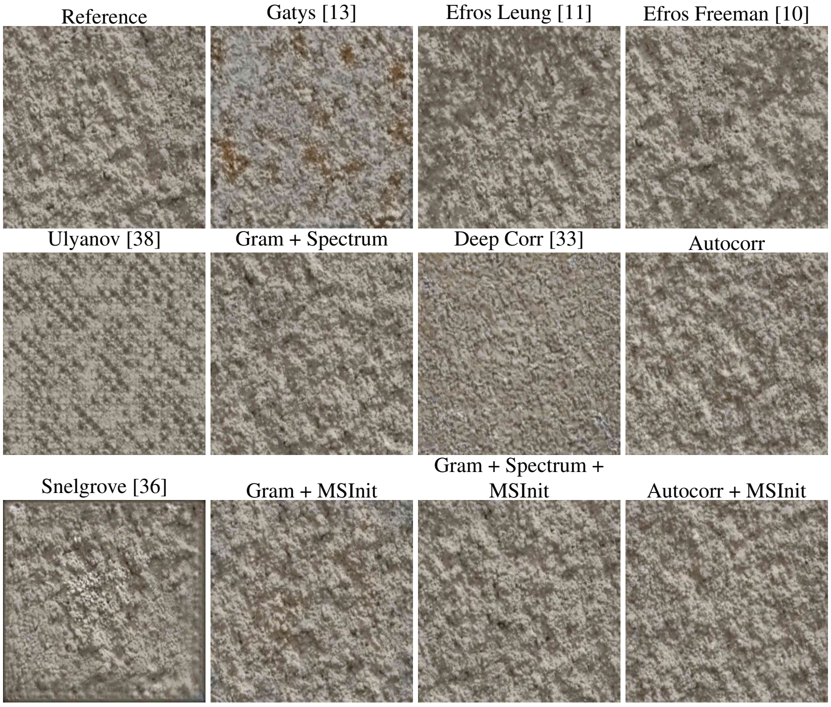

Fig. 2.3 Synthesis results using different methods for one given reference of size 1048×1048.

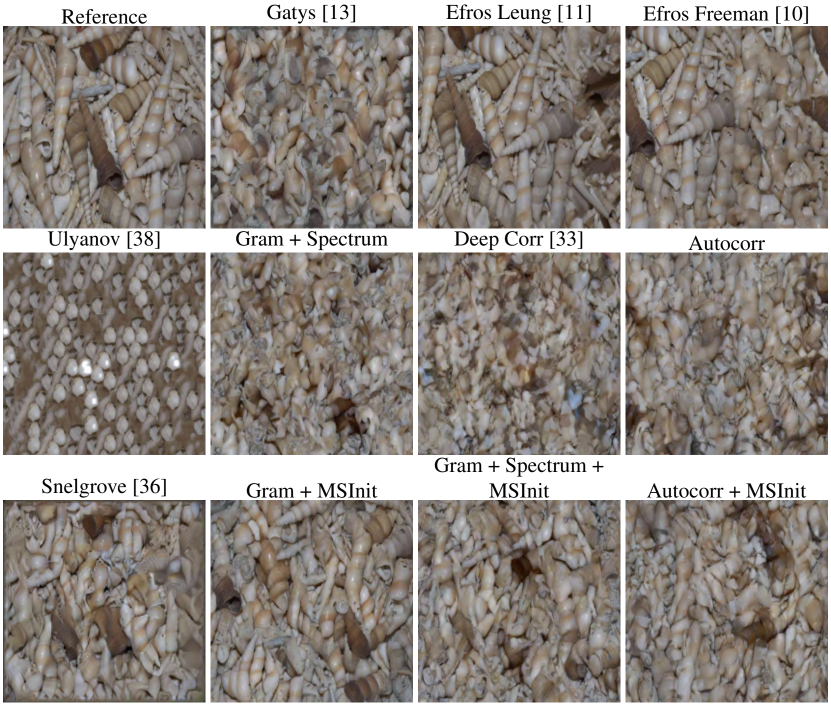

Fig. 2.4 Synthesis results using different methods for one given reference of size 1048×1048.

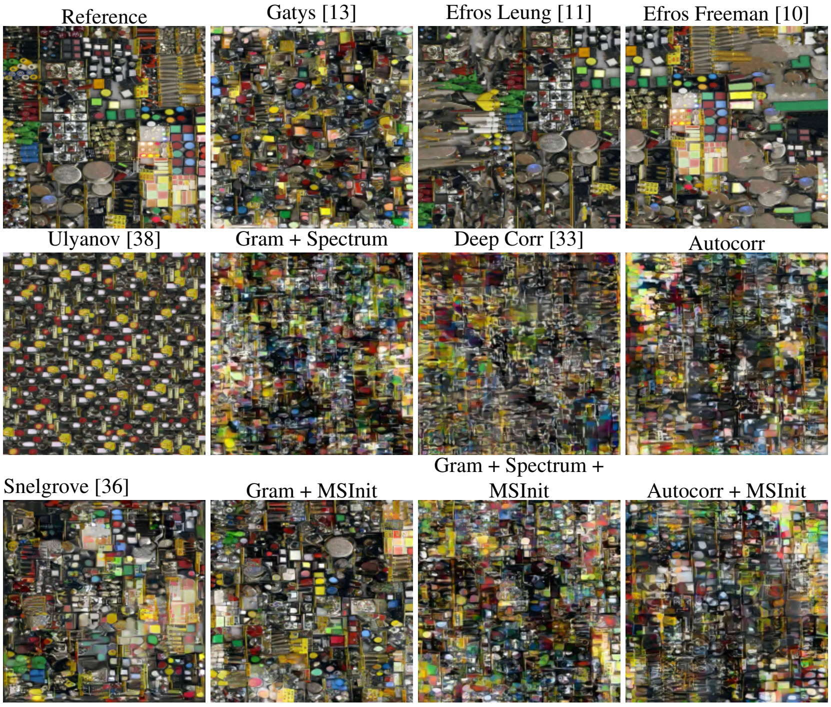

Fig. 2.5 Synthesis results using different methods for one given reference of size 1048×1048.

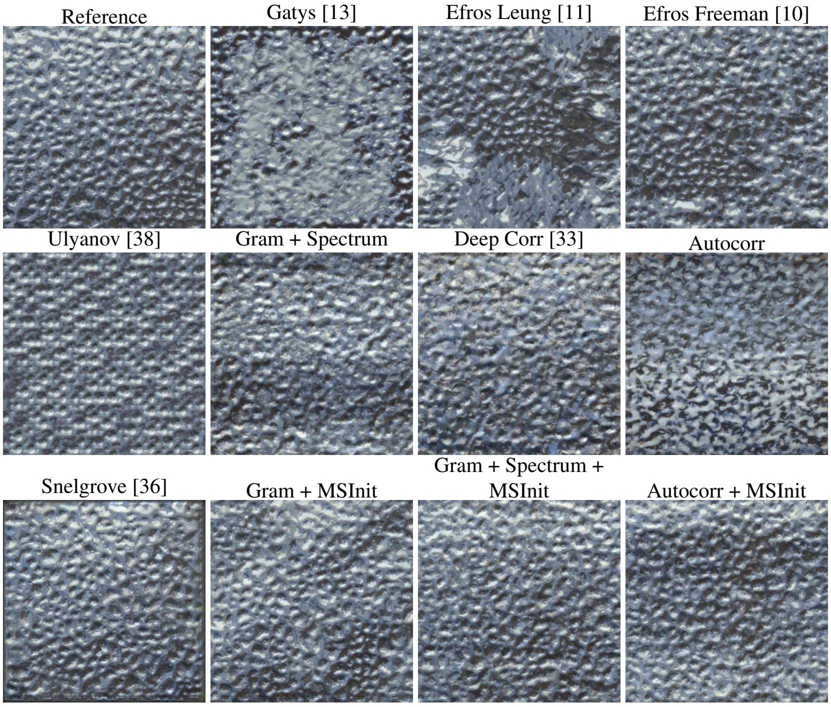

Fig. 2.6 Synthesis results using different methods for one given reference of size 1048×1048.

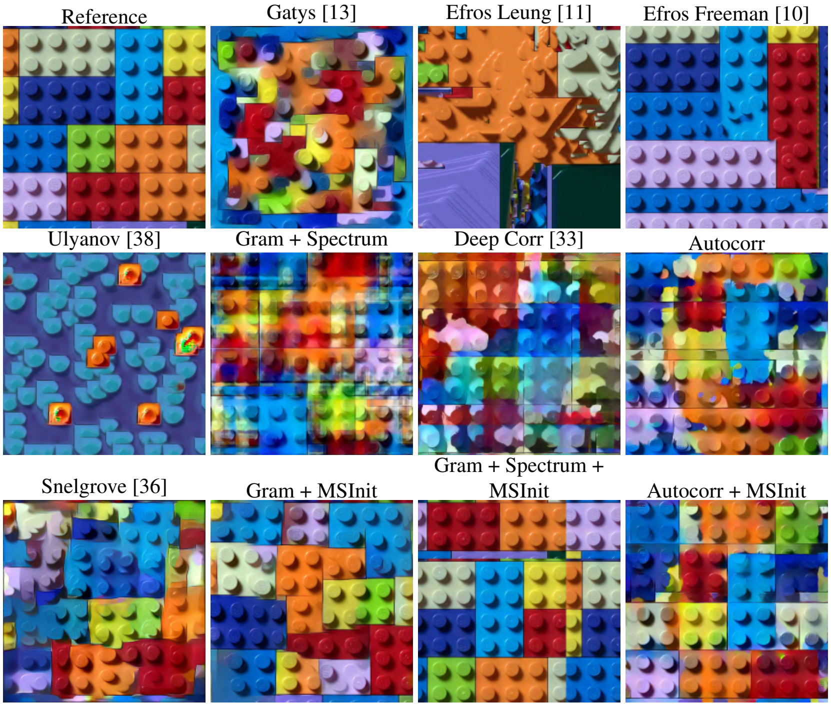

Fig. 2.7 Synthesis results using different methods for one given reference of size 1048×1048.

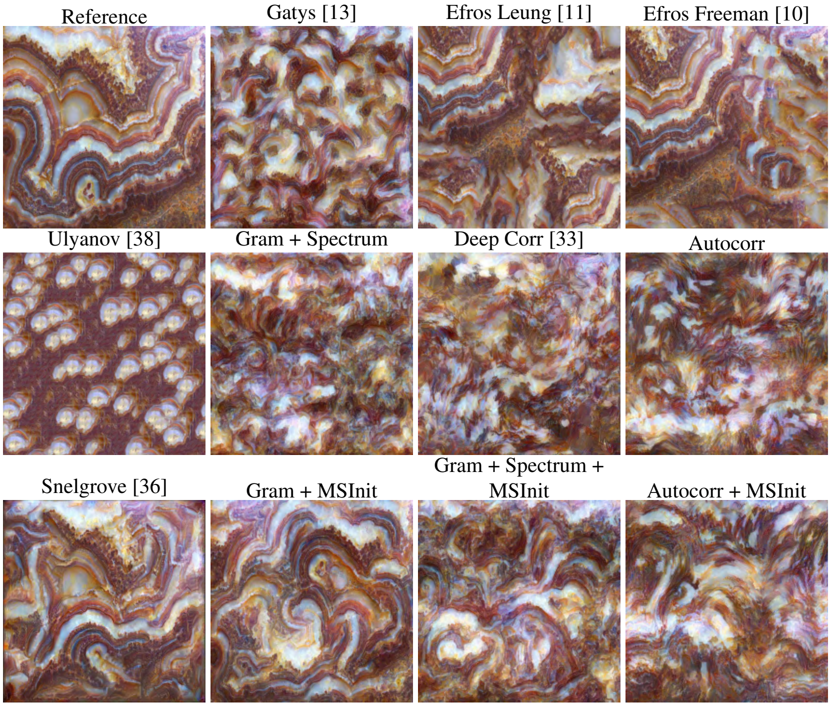

Fig. 2.8 Synthesis results using different methods for one given reference of size 1048×1048.

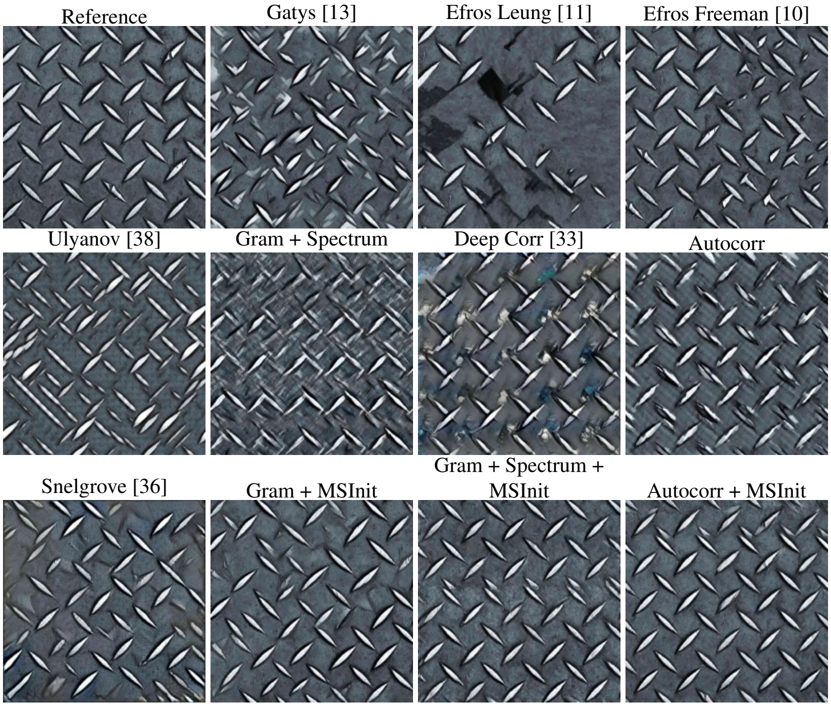

Fig. 2.9 Synthesis results using different methods for one given reference of size 1048×1048.

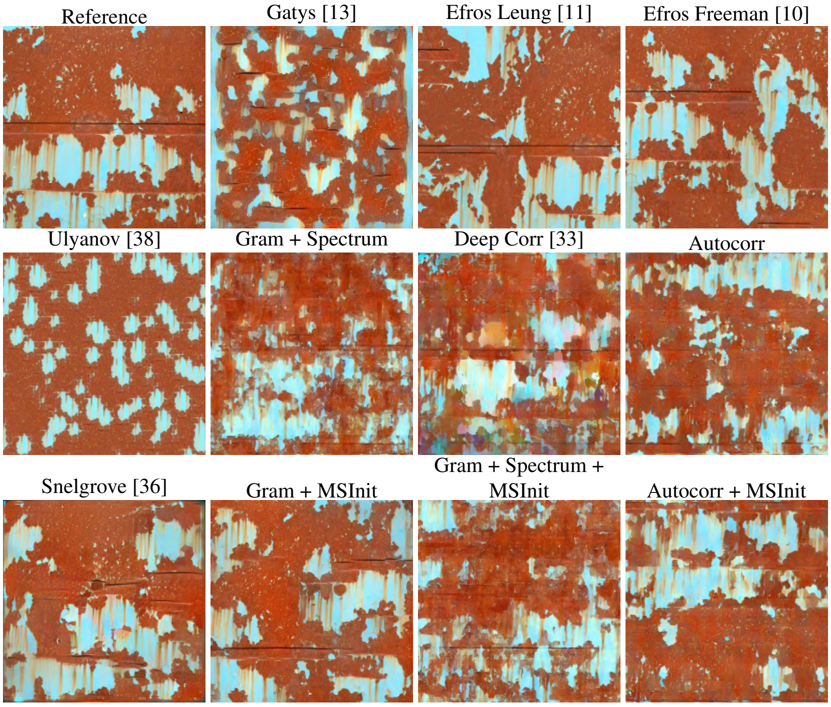

Fig. 2.10 Synthesis results using different methods for one given reference of size 1048×1048.

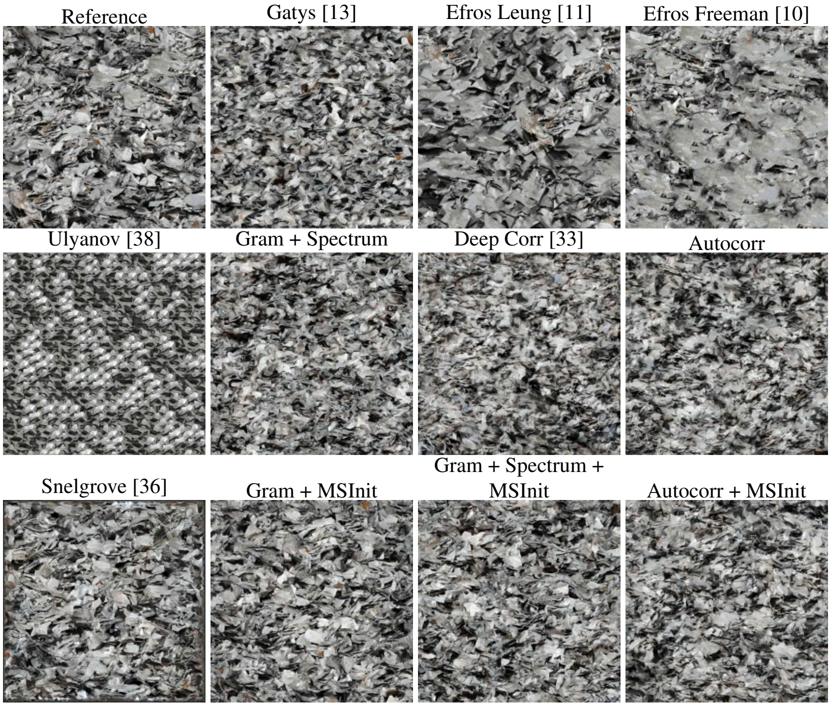

Fig. 2.11 Synthesis results using different methods for one given reference of size 1048×1048.

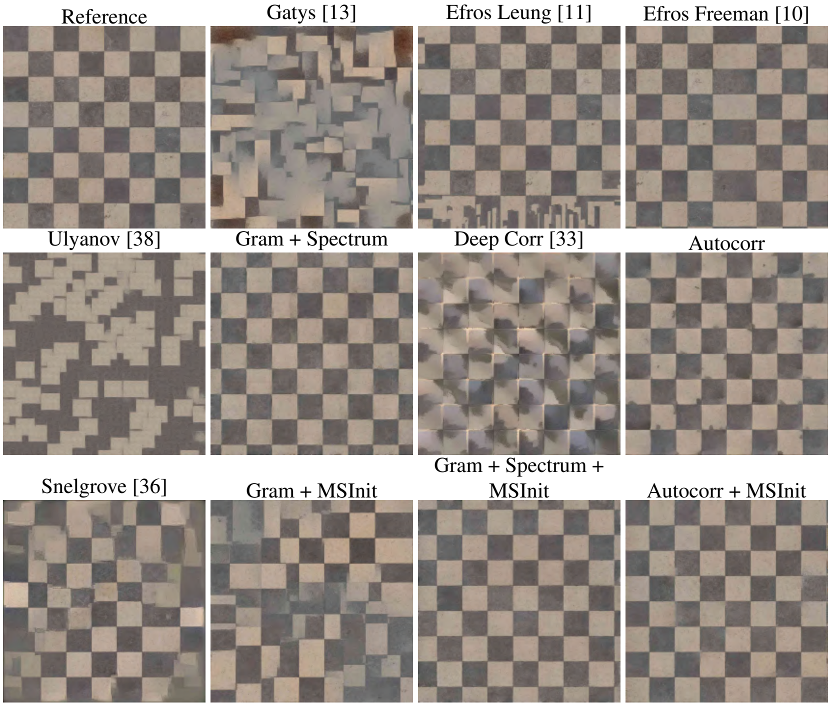

Fig. 2.12 Synthesis results using different methods for one given reference of size 1048×1048.

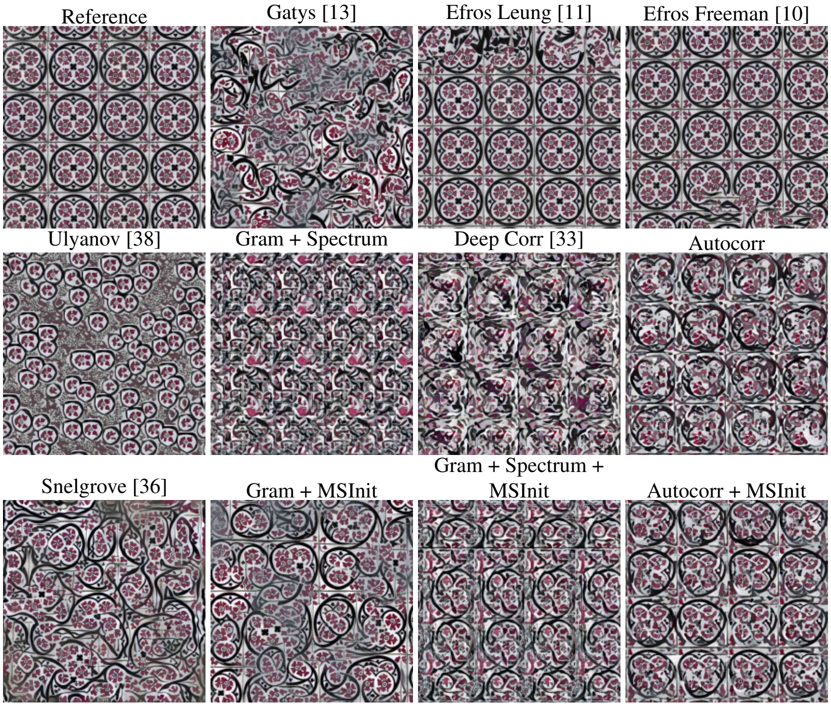

Fig. 2.13 Synthesis results using different methods for one given reference of size 1048×1048.

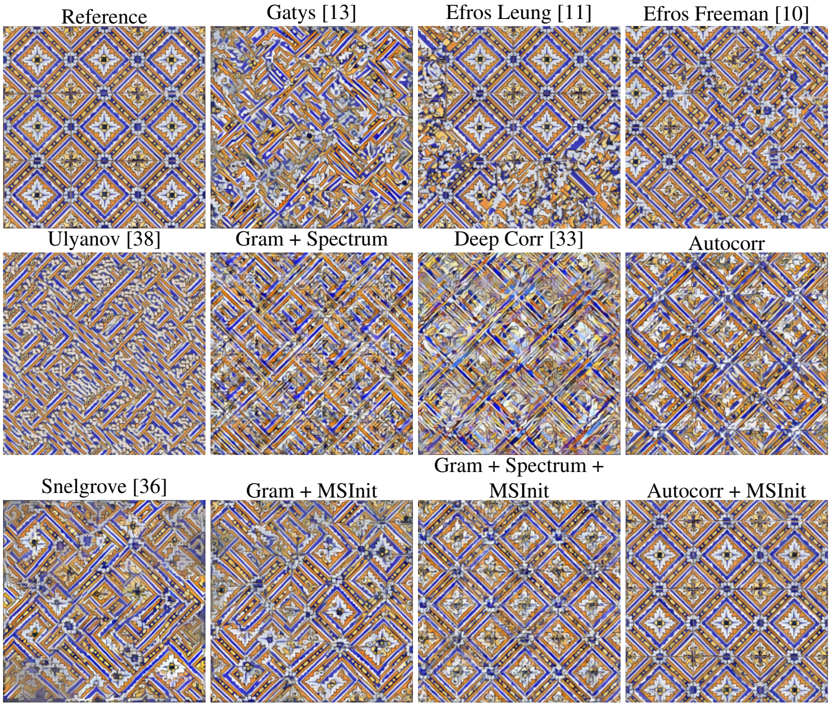

Fig. 2.14 Synthesis results using different methods for one given reference of size 1048×1048.

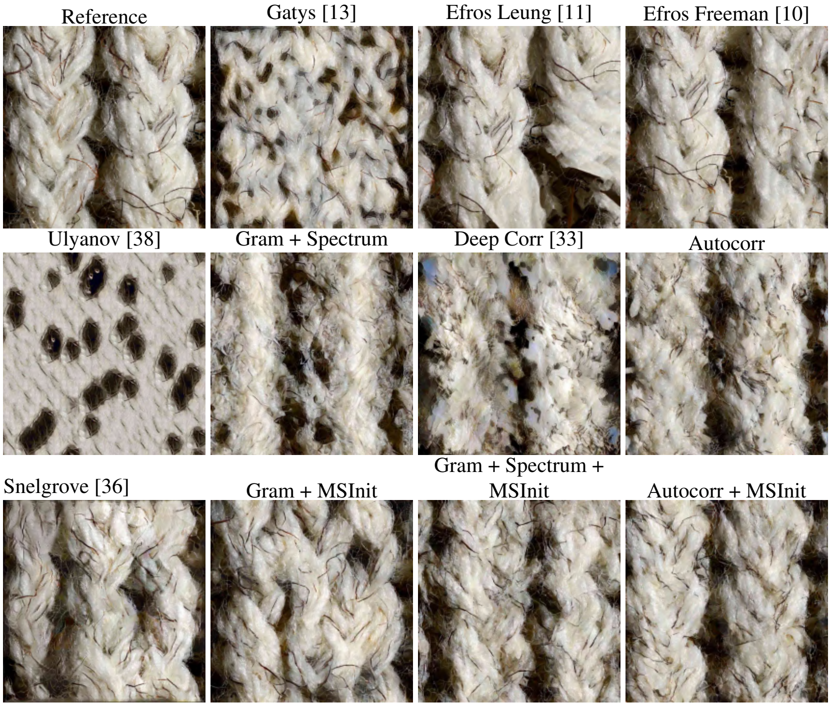

Fig. 2.15 Synthesis results using different methods for one given reference of size 1048×1048.

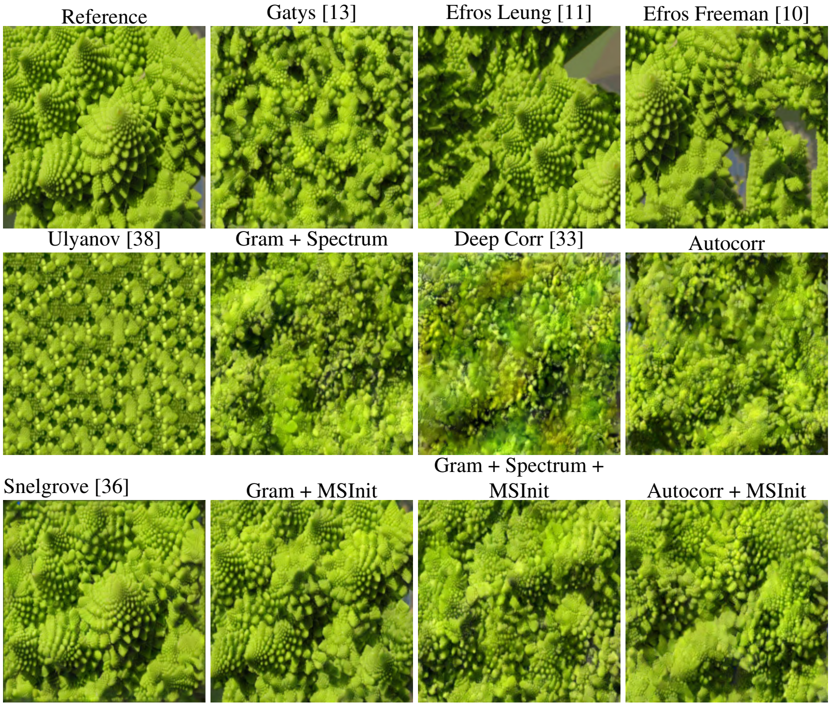

Fig. 2.16 Synthesis results using different methods for one given reference of size 1048×1048.

3 More high resolution synthesis

In this section, one can see in Figures 2.1 to 2.12 more synthesis of 2048×2048 images for diverse reference texture.

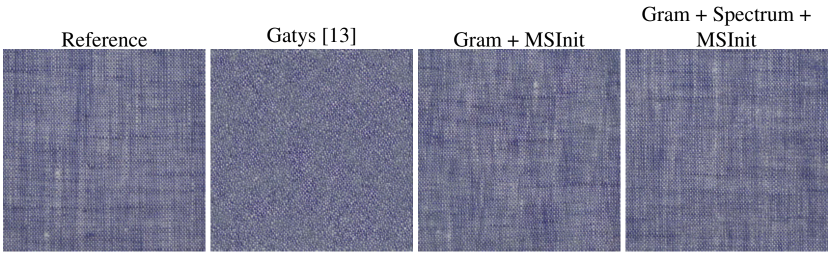

Fig. 3.1 Synthesis results using different methods for one given reference of size 2048×2048.

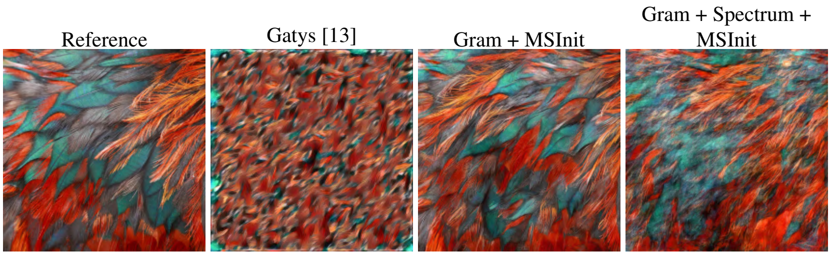

Fig. 3.2 Synthesis results using different methods for one given reference of size 2048×2048.

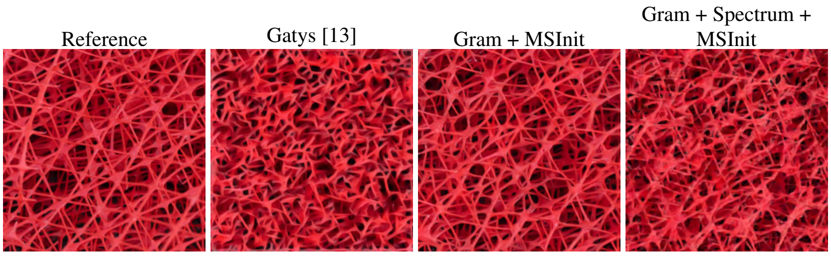

Fig. 3.3 Synthesis results using different methods for one given reference of size 2048×2048.

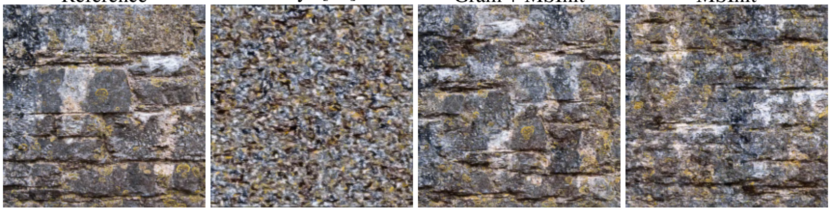

Fig. 3.4 Synthesis results using different methods for one given reference of size 2048×2048.

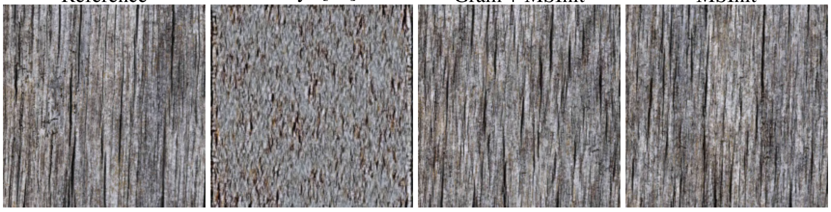

Fig. 3.5 Synthesis results using different methods for one given reference of size 2048×2048.

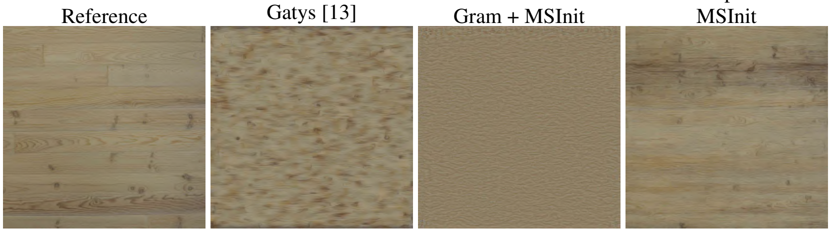

Fig. 3.6 Synthesis results using different methods for one given reference of size 2048×2048.

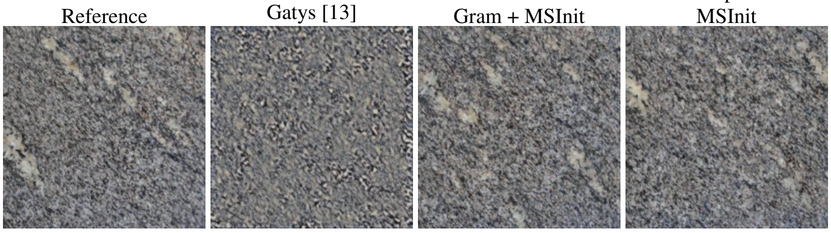

Fig. 3.7 Synthesis results using different methods for one given reference of size 2048×2048.

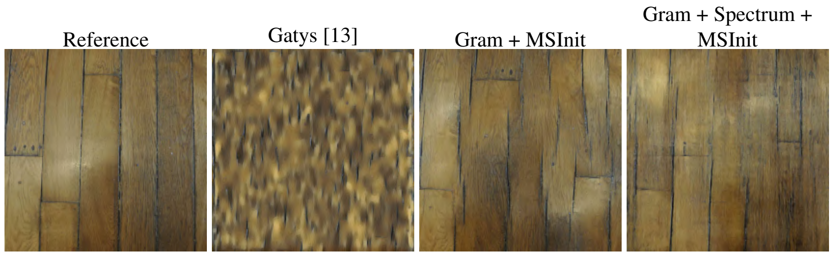

Fig. 3.8 Synthesis results using different methods for one given reference of size 2048×2048.

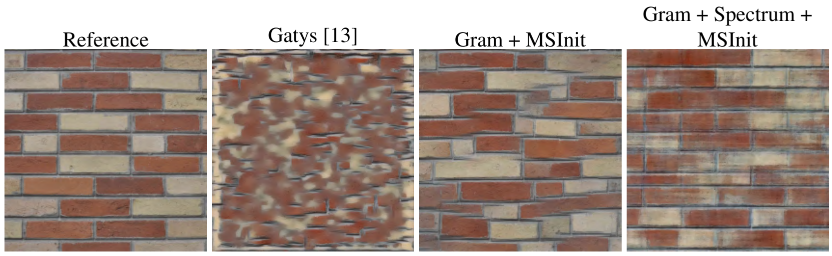

Fig. 3.9 Synthesis results using different methods for one given reference of size 2048×2048.

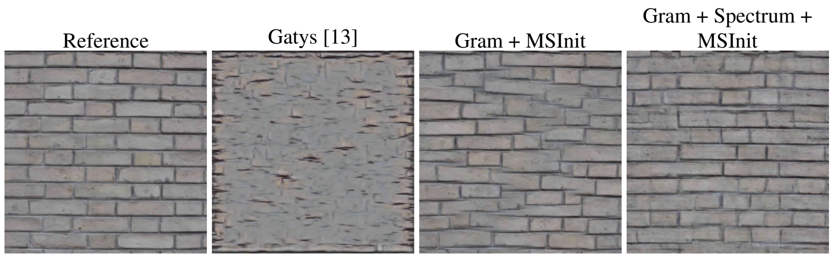

Fig. 3.10 Synthesis results using different methods for one given reference of size 2048×2048.

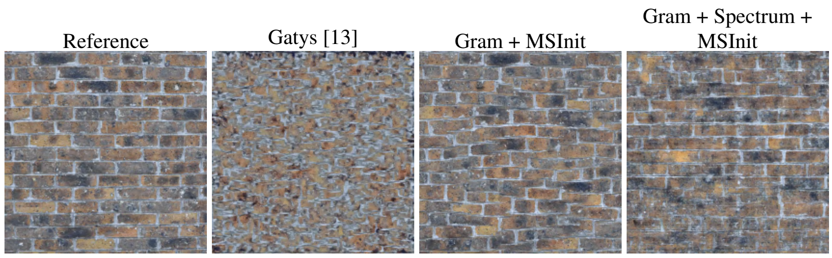

Fig. 3.11 Synthesis results using different methods for one given reference of size 2048×2048.

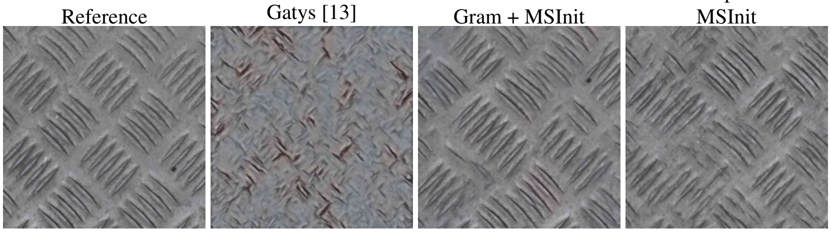

Fig. 3.12 Synthesis results using different methods for one given reference of size 2048×2048.