

Initial Standard Guess for Phase Retrieval Algorithms

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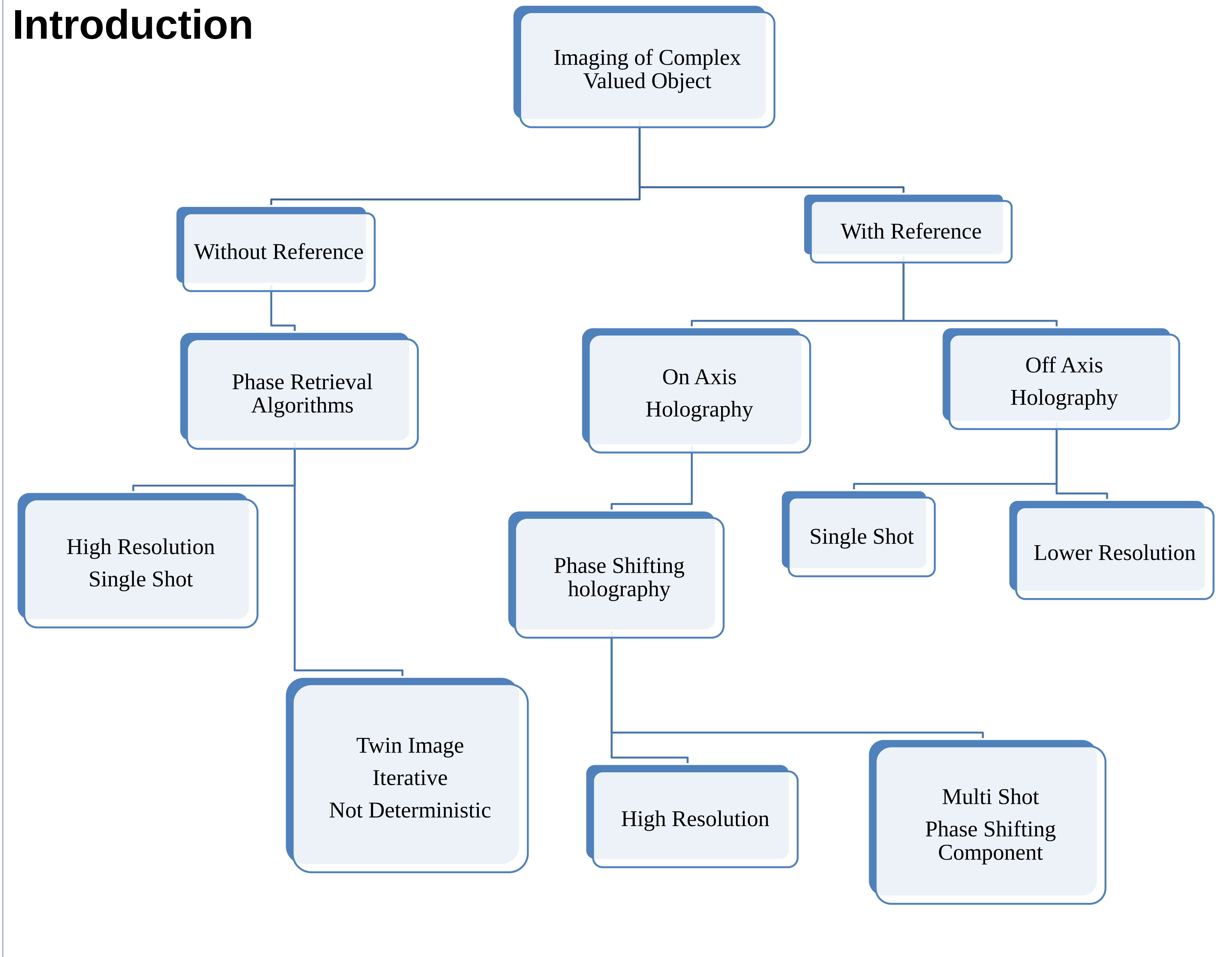
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Abstract: We present a novel method to provide a standard guess from the object autocorrelation which can be used in any Phase Retrieval Algorithms (PRA) as an initial guess. Simulated result using this method shows less error, fast convergence and twin image free output compared to the random guess.

Introduction



Principle

$$g(x, y) = f(x, y) + c\delta(r - r_o)$$

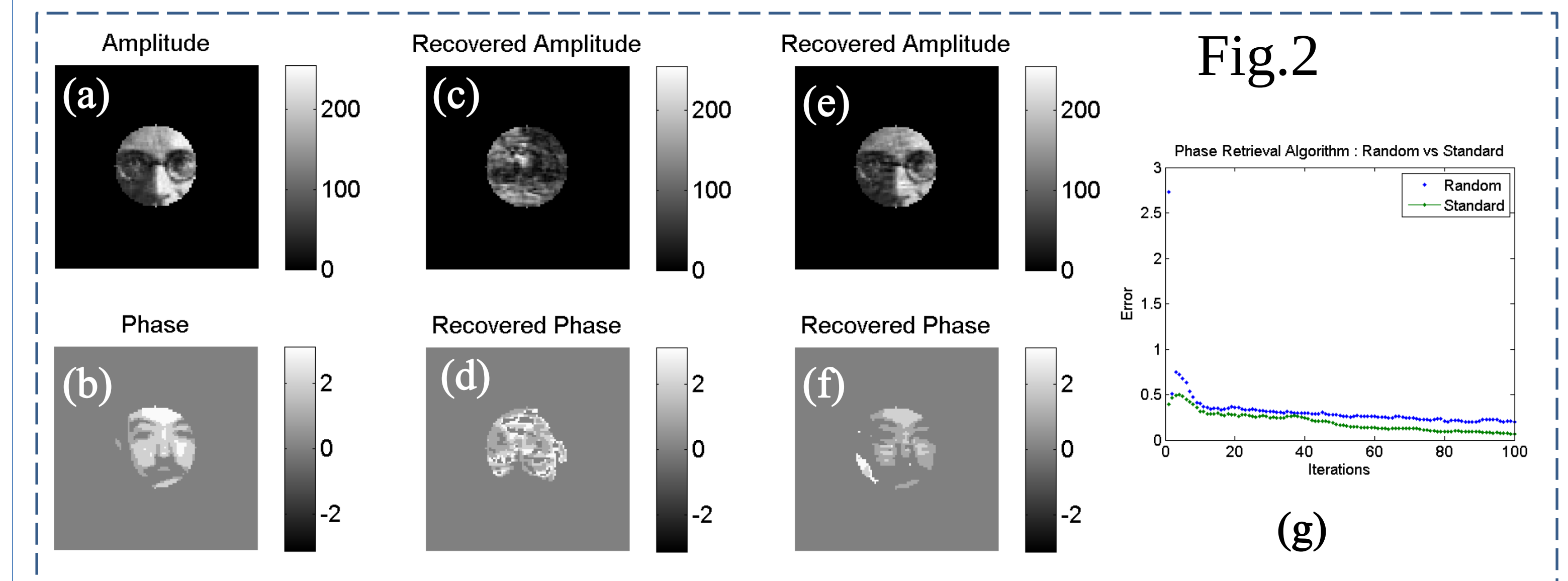
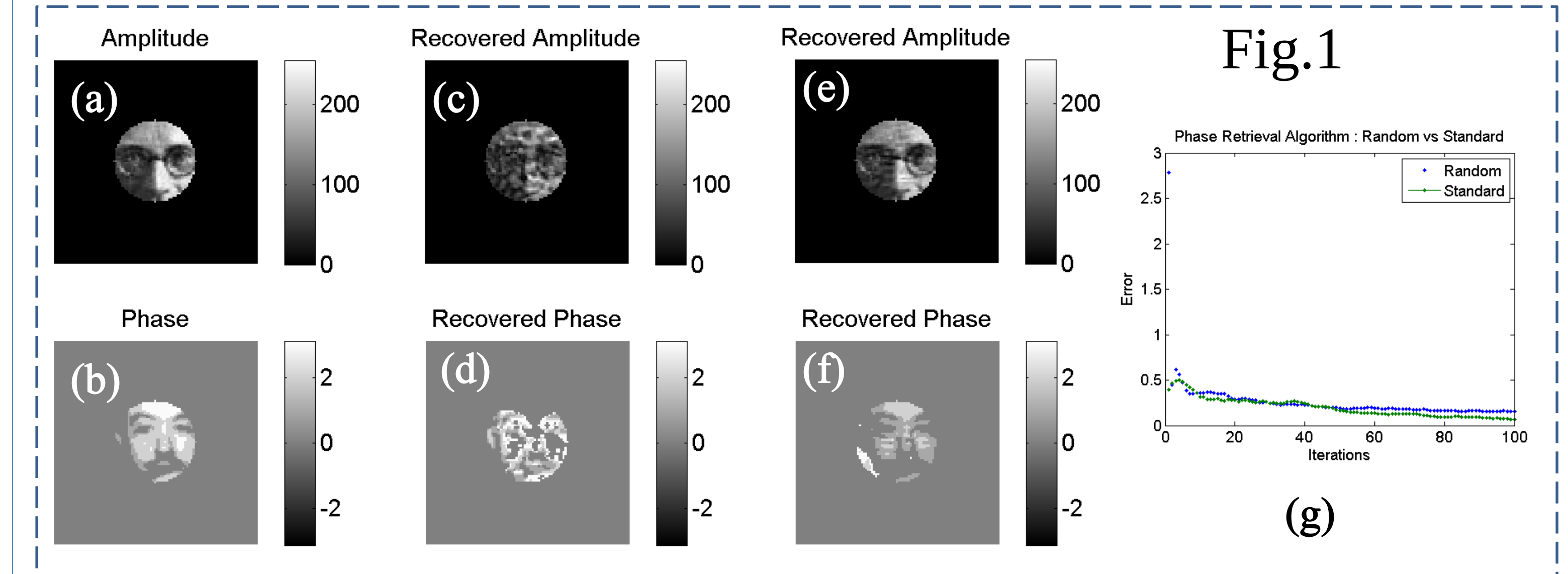
$$G(u, v) = F(u, v) + c \exp(-i2\pi k \cdot r_o)$$

$$I = |G(u, v)|^2 = |F(u, v)|^2 + |c|^2 + F^* c \exp(-i2\pi k \cdot r_o) + F c^* \exp(i2\pi k \cdot r_o)$$

$$g'(x, y) = I.F.T.(I) = f \otimes f + |c|^2 \delta(0) + f^* c \otimes \delta(r - r_o) + f c^* \otimes \delta(r + r_o)$$

cropped the 4th term from the above equation, using it as an initial guess solution for PRA instead of random guess to start the algorithms leads to fast convergence and give accurate and deterministic results every time the algorithm runs without resulting in DC and twin image problem.

Results and Conclusion



In the simulation, we use the Hybrid Input Output phase retrieval algorithms (PRA). As shown in Fig.1(a-b), images of Erwin Schrödinger and Prince Louis de Broglie are used as an object amplitude and phase. The reconstructed amplitude and phase of the images obtain from random and standard guesses are shown in Fig.1 (c-d) and Fig.1 (e-f), respectively. According to Fig.1 (g), the error in case of random guess is greater than the proposed standard guess. This figure also indicates that the algorithm converges faster when the standard guess is used instead of the random guess. The sequence of the images in Fig.2 is same as in Fig. 1. However, this data is obtained when the algorithm is executed the second time, its output clearly shows that the algorithm based on the random guess is non-deterministic and may generate twin image while the algorithm based on standard guess gives the deterministic output.

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