Response to Reviewer 1's Comments

Manuscript ID: **sensors-808550**
Title: **Anomaly detection neural network with dual auto-encoders GAN and its industrial inspection applications**
Author: **Ta-Wei Tang, Wei-Han Kuo, Jauh-Hsiang Lan, Chien-Fang Ding *, Hakiem Hsu, Hong-Tsu Young**

Thank you very much for the Editor's letter. Enclosed please find one copy of the revised manuscript of the above-mentioned paper which has been carefully prepared following your suggestions. In addition, the authors would like to thank the referees for the valuable comments. The following changes or corrections are made in the revised manuscript according to the referees' comments:

Reviewer's comments:

Point 1. Firstly, the paper needs a significant revision in English. Incomprehensible language and incoherent narratives are a big impediment to reading this paper.

Response 1. Thanks for reviewer's comment. We have revised the paper sentence by sentence and corrected the problem of language using and grammar mistakes in the paper. Please check it in the revised manuscript.

Point 2. The paper is quite long without any significant need or new content. The paper length can be shortened to 1/2 or 2/3 of the current size to approximately 8-10 pages.

Response 2. Thanks for reviewer's comment. We have carefully deleted unnecessary sentences and shortened the paper to the size of 11 pages. Please check it in the revised manuscript.

Point 3. The paper has multiple areas of repetition where the authors say the same thing over and over again and sometimes in the same language. Please correct this and make it terser.

Response 3. Thanks for reviewer's comment. We have revised the paper and removed the areas of repetition. Please check it in the revised manuscript.

Point 4. Lines 6-8: The authors claim that dual-autoencoders GAN is "brand

new". This is markedly false. This architecture is well-known in the ML community. Among many examples, one example is https://ieeexplore.ieee.org/document/8483579

Response 4. Thanks for reviewer's comment. We have removed the word "brand new" and described that we proposed a dual-autoencoders GAN based anomaly detection model called DAGAN. Since this is the first paper applying this architecture to anomaly detection, we still think it has the value of mention. Please check it in the revised manuscript.

Point 5. Line 49-59: The authors use the term "normal data". To most of the ML community, this would mean data that is normally/Gaussian distributed. Please be careful before using terms that have mathematically specific meanings.

Response 5. Thanks for reviewer's comment. We checked the paper and replaced "normal data" with "normal samples", which was used in previous papers of anomaly detection such as Skip-GANomaly. Please check it in the revised manuscript.

Point 6. Line 276: It is clear from the values of the hyperparameters used to control the contribution of the 3 component loss functions to the total loss function that the contextual loss of the generator is crucial since it is weighted as 40 times more important than the other 2 components. The contextual loss of the generator is nothing but the reconstruction loss of the an autoencoder. This reviewer is therefore strongly suspicious that there is NO need of a discriminator or an adversarial loss. In other words, a GAN is NOT required for this problem. Simply training a plain autoencoder should be sufficient since that is what the authors seem to be doing anyway. The authors MUST justify why the neural architecture is a GAN and not simply a plain autoencoder.

Response 6. Thanks for reviewer's comment. We trained the U-Net autoencoder and added the results to this paper. The result show that the AUCs of DAGAN were significantly higher than those of the U-Net were in the four categories, i.e., carpet, metal nut, toothbrush, and transistor. This is because without the discriminator, the only goal of the U-Net auto-encoder is to reconstruct the image perfectly. Consequently, it reconstructed the defect in the image, which decreased its detection ability in these categories. Therefore, the discriminator is necessary in this application. Please check it in the revised manuscript.

Point 7. Figure 10 is not required. Plotting table 2 is redundant since there are just 2 categories.

Response 7. Thanks for reviewer's comment. We already removed Figure 10. Please check it in the revised manuscript.