CLAIMS

1. An apparatus for generating and synthesizing image data for event detection, the apparatus comprising an artificial intelligence-based image generator module and at least one processor, the at least one processor configured to:

generate a random noise feature, the random noise feature configured to provide a random variation to a first image data and a second image data;

synthesize the first image data with the random noise feature to obtain the synthesized first image data, wherein the first image data comprises at least one layout data of an event;

generate the second image data using the artificial intelligence-based image generator module which is configured to receive the layout data and the random noise feature as inputs to generate the second image data as output, wherein the second image data comprises the event and a background associated with the event; and

combine the synthesized first image data and the second image data to form a pair of synthesized image data.

2. The apparatus according to claim 1, wherein the random noise feature is a Gaussian noise feature.

3. The apparatus according to claim 1 or 2, wherein the image generator module is configured as a convolutional artificial neural network, the convolutional artificial neural network comprising one or more fully connected layers, wherein the artificial neural network is configured as a generator in a generative adversarial network.

4. The apparatus according to claim 3, wherein the generative adversarial network comprises the generator and a discriminator, and the generator is configured to generate plausible data associated with the event, the plausible data configured as negative training examples for the discriminator.

5. The apparatus according to any one of the preceding claims, further comprises a layout generator module, the layout generator module configured to generate a plurality of first image data, and wherein the plurality of first image data comprises one or more augmented

characteristic features of the event, the one or more augmented characteristic features of the event derived from at least one realistic feature of the event.

6. The apparatus according to claim 5, wherein the at least one augmented characteristic features are obtained by a transformation of the at least one realistic feature of the event, the transformation comprises an application of a rotation parameter on the actual characteristic feature.

7. The apparatus according to any one of the preceding claims, further comprises a background refinement module, the background refinement module configured to refine complex and unrealistic generated synthesized image data.

8. The apparatus according to claim 7, wherein the background refinement module is configured to superimpose the at least one characteristic feature, the at least one characteristic feature comprising a foreground of an event onto a random realistic background and apply a boundary blur function to the foreground outer pixels of the foreground.

9. The apparatus according to any one of the preceding claims, wherein the event is a fire, and the at least one characteristic feature of the event comprises a fire plume.

10. A system for providing synthesized image data for training an image segmentation model, the system comprising

the apparatus of any one of claims 1 to 9, the apparatus configured to produce the pair of synthesized image data;

a segmentation module, the segmentation module configured to receive the pair of synthesized image data generated by the apparatus as input;

wherein the segmentation module comprises a fully convolutional network, and the pair of synthesized image data form at least a part of a training set to train the fully convolutional network.

11. The system according to claim 10, wherein the fully convolutional network comprises a U-net network.

12. The system according to claim 11, wherein the U-net network comprises a ResNet-50 backbone, the ResNet-50 backbone configured to be used for feature extraction.

13. The system according to claim 11 or 12, wherein the U-Net is configured to provide segmentation in an encode-decode manner, wherein one or more feature maps are extracted from input images through a plurality of encoder and decoder blocks, and wherein has the number of feature maps equal to the number of segments to be segmented by the U-net.

14. An event detection system comprising the apparatus of any one of claims 1 to 9, and the trained image segmentation model of any one of claims 11 to 13, the event detection system comprising:

a real-time image-capturing device, the real-time image-capturing device configured to capture a video stream;

a processor configured to send the video stream to the trained image segmentation model for the determination of whether an event is present or absent;

wherein in a positive determination of a fire event, the processor is configured to provide at least one of the following actions: trigger an alarm, send a notification to an event-handling authority, and a public warning.

15. A method for generating image data for event detection, the method comprising the steps of:

generating a random noise feature, the random noise feature configured to provide a random variation to at least one of the first image data and the second image data;

synthesizing the first image data with the random noise feature to obtain the synthesized first image data, the first image data comprising at least one layout data of an event;

generating a second image data by using the artificial intelligence-based image generator module which is configured to receive the layout data and the random noise feature as inputs to generate the second image data as output, wherein, the second image data comprises the event and a background associated with the event; and

combining the synthesized first image data and the second image data to form a pair of synthesized image data.

16. The method according to claim 15, wherein the random noise feature is a Gaussian noise feature.

17. The method according to claim 15 or 16, wherein the image generator module is configured as a convolutional neural network, the convolutional neural network comprising one or more fully connected layers, wherein the artificial neural network is configured as a generator in a generative adversarial network.

18. The method according to claim 17, wherein the generative adversarial network comprises the generator and a discriminator, and the generator is configured to generate plausible data associated with the event, the plausible data configured as negative training examples for the discriminator.

19. The method according to any one of claims 15 to 18, further comprises generating a plurality of first image data, wherein generating the plurality of first image data further comprises providing at least one realistic feature of the event, and deriving, based on the at least one realistic feature of the event, one or more augmented characteristic features of the event.

20. A computer program, the computer program comprising instructions to execute the method according to any one of claims 15 to 19.