



Supporting Information

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Machine-Learning-Based Monitoring of Laser Powder Bed Fusion

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The CNN has 3 convolutional layers (“conv-layers”) with 32 feature maps of 3×3 kernels, 64 feature maps of 3×3 kernels, and 64 feature maps of 3×3 kernels respectively. The first two conv-layers, CONV-1 and CONV-2, precede a ReLU activation^[1] and 2×2 mean-pooling layer^[2]. The third conv-layer, CONV-3, precedes ReLU activation. Next a fully connected layer^[3] (fc-layer) of 1000 hidden units, FC-1, is connected with CONV-3, and followed by a dropout layer^[4] with 0.5 dropout rate. Then two more fully connected layers, FC-2 and FC-3, with 200 and 20 hidden units, respectively, connect to FC-1, and each precede a sigmoid activation^[5,6]. FC-3 is fully connected to the final output layer consisting of a single unit, which corresponds to the track width value, standard deviation, or continuity classification. The standard loss function is used for the regression predictions, while cross entropy loss is used for classification. During the training, the Adam optimizer is chosen with a learning rate of 10^{-4} for regression or 10^{-5} for classification, batch size of 20, and max training epoch number of 300. L2 regularization is applied to all the weights for suppressing over fitting. The regularization coefficient is set as 10^{-4} .

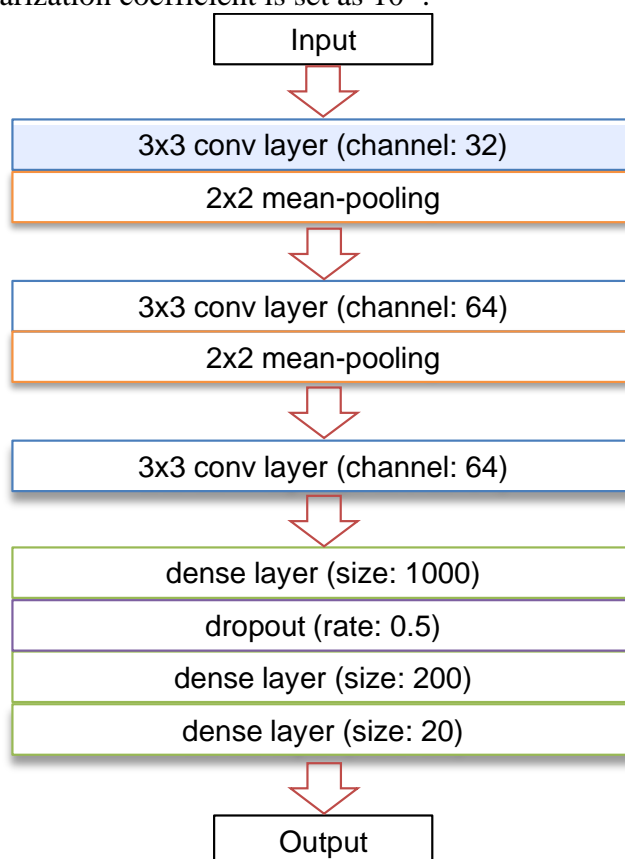


Figure SI1. Machine learning model architecture schematic.

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