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# For DIVA

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Recent developments in the field of Semi-Supervised Learning are working to avoid the bottleneck of data labeling. This can be achieved by leveraging unlabeled data to limit the amount of labeled data needed for training deep learning models.

Semi-supervised learning algorithms are showing promising results; however, research has been focusing on algorithm development, without proceeding to test their effectiveness in real-world applications.

This research project has adapted and tested some semi-supervised learning algorithms on a dataset extracted from the manufacturing environment, in the context of the surface analysis of stainless steel, in collaboration with Outokumpu Stainless Oy. In particular, a simple algorithm combining Pseudo-Labeling and Consistency Regularization has been developed, inspired by the state-of-the-art algorithm Fixmatch.

The results show some potential, because the usage of Semi-Supervised Learning techniques has significantly reduced overfitting on the training set, while maintaining a good accuracy on the test set. However, some doubts are raised regarding the application of these techniques in a real environment, due to the imperfect nature of real datasets and the high algorithm development cost due to the increased complexity introduced with these methods.

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"Keywords[eng]": €€€  
Deep Learning, Computer Vision, Semi-Supervised Learning, Automatic Inspection, Stainless Steel €€€,  
"Abstract[swedish]": €€€

Den senaste utvecklingen inom området Semi-Supervised Learning arbetar för att undvika flaskhalsen med datamärkning. Detta kan uppnås genom att utnyttja omärkta data för att begränsa mängden märkt data som behövs för att träna modeller för djupinlärning.

Semi-övervakade inlärningsalgoritmer visar lovande resultat; forskning har dock fokuserat på algoritmutveckling, utan att testa deras effektivitet i verkliga tillämpningar.

Detta forskningsprojekt har anpassat och testat några semi-övervakade inlärningsalgoritmer på en datauppsättning extraherad från tillverkningsmiljön, i samband med ytanalys av rostfritt stål, i samarbete med Outokumpu Stainless Oy.

I synnerhet har en enkel algoritm som kombinerar Pseudo-Labeling och Consistency Regularization utvecklats, inspirerad av den toppmoderna algoritmen Fixmatch.

Resultaten visar en viss potential, eftersom användningen av Semi-Supervised Learning-tekniker avsevärt har minskat överanpassningen av träningssetet, samtidigt som en god noggrannhet på testsetet bibehålls.

Vissa tvivel reses dock angående tillämpningen av dessa tekniker i en verklig miljö, på grund av den ofullkomliga karaktären hos riktiga datauppsättningar och den höga algoritmutvecklingskostnaden på grund av den ökade komplexiteten som introduceras med dessa metoder.

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