Complete A.I. & Machine Learning, Data Science Bootcamp



**138. Machine Learning Model Evaluation**

**Course content**

Play

100. Section Overview

 2min

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101. Scikit-learn Introduction

7min

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102. Quick Note: Upcoming Video

 1min

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103. Refresher: What Is Machine Learning?

 6min

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104. Quick Note: Upcoming Videos

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105. Scikit-learn Cheatsheet

6min

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106. Typical scikit-learn Workflow

23min

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107. Optional: Debugging Warnings In Jupyter

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108. Getting Your Data Ready: Splitting Your Data

9min

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109. Quick Tip: Clean, Transform, Reduce

 5min

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110. Getting Your Data Ready: Convert Data To Numbers

 17min

 Start

111. Note: Update to next video (OneHotEncoder can handle NaN/None values)

 1min

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112. Getting Your Data Ready: Handling Missing Values With Pandas

 12min

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113. Extension: Feature Scaling

 1min

 Start

114. Note: Correction in the upcoming video (splitting data)

 1min

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115. Getting Your Data Ready: Handling Missing Values With Scikit-learn

 17min

 Play

116. NEW: Choosing The Right Model For Your Data

20min

  Play

117. NEW: Choosing The Right Model For Your Data 2 (Regression)

 11min

 Start

118. Quick Note: Decision Trees

 1min

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119. Quick Tip: How ML Algorithms Work

 1min

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120. Choosing The Right Model For Your Data 3 (Classification)

 13min

 Play

121. Fitting A Model To The Data

 7min

 Play

122. Making Predictions With Our Model

 8min

 Play

123. predict() vs predict\_proba()

 9min

 Play

124. NEW: Making Predictions With Our Model (Regression)

 9min

 Play

125. NEW: Evaluating A Machine Learning Model (Score) Part 1

 10min

 Play

126. NEW: Evaluating A Machine Learning Model (Score) Part 2

 7min

 Play

127. Evaluating A Machine Learning Model 2 (Cross Validation)

 13min

 Play

128. Evaluating A Classification Model 1 (Accuracy)

 5min

 Play

129. Evaluating A Classification Model 2 (ROC Curve)

 9min

 Play

130. Evaluating A Classification Model 3 (ROC Curve)

 8min

 Start

131. Reading Extension: ROC Curve + AUC

 1min

 Play

132. Evaluating A Classification Model 4 (Confusion Matrix)

11min

  Play

133. NEW: Evaluating A Classification Model 5 (Confusion Matrix)

 14min

 Play

134. Evaluating A Classification Model 6 (Classification Report)

 10min

 Play

135. NEW: Evaluating A Regression Model 1 (R2 Score)

 10min

 Play

136. NEW: Evaluating A Regression Model 2 (MAE)

 7min

 Play

137. NEW: Evaluating A Regression Model 3 (MSE)

 10min

 Start

138. Machine Learning Model Evaluation

 3min

 Play

139. NEW: Evaluating A Model With Cross Validation and Scoring Parameter

 25min

 Play

140. NEW: Evaluating A Model With Scikit-learn Functions

 14min

 Play

141. Improving A Machine Learning Model

 11min

 Play

142. Tuning Hyperparameters

 23min

 Play

143. Tuning Hyperparameters 2

 14min

 Play

144. Tuning Hyperparameters 3

 15min

 Start

145. Note: Metric Comparison Improvement

 1min

 Play

146. Quick Tip: Correlation Analysis

 2min

 Play

147. Saving And Loading A Model

 7min

 Play

148. Saving And Loading A Model 2

 6min

 Play

149. Putting It All Together

20min

  Play

150. Putting It All Together 2

12min

  Start

151. Scikit-Learn Practice

* 1min

**Student feedback**

4.6

Rating: 4.593951 out of 5

Course Rating

**Reviews**

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JP

Jeronimo P.

Rating: 4.5 out of 5

6 days ago

Overall the course is really helpful and well explained. I strongly recommend it. However, my recommendations to ZTM is to update some small details since its a course and examples of 2019/2020. And 2nd it would be really helpful that you guys answers some questions. I understand that maybe there are lots of people and lots of questions, but leaning something like this sometimes need 1-1 Q&A that google or blogs cannot help.

Was this review helpful?

CS

CHUKWU AJAH S.

Rating: 5.0 out of 5

a month ago

following this practical course made it easy for me to understand the textbook

hands on machine learning.

anyone looking out for a practical course should have this one also. It also accommodates beginners.

Was this review helpful?

JG

John G.

Rating: 5.0 out of 5

a month ago

This was an amazing course, I couldn't stop once I started. This course is well thought out and exceeded all my expectations. I have taken several courses on Udemy and this one was the best by far! Looking forward to taking the second part of this course.

Was this review helpful?

DL

Danielle Maria Perez L.

Rating: 5.0 out of 5

2 months ago

I had a great time and it helped me a lot to code along as well as having clear instructions. I got the Pytorch and Tensor Flow courses from ZTM as well and intend to continue learning DS with them. :)

Was this review helpful?

MN

Mukwa N.

Rating: 4.5 out of 5

a month ago

This course is worth taking for beginners and intermediate levels in Data Science. Learners will learn valuable information and there are enough opportunities to apply what I learned. The reason my rating is 4.5 is because it seems to be an intermediate level as per my level.

Was this review helpful?

MB

Muhammed B.

Rating: 1.0 out of 5

3 weeks ago

The training content is successful, the source and information is good, but I got an error in some code. I didn't get an efficient notification on Discord. The questions asked to the videos are often unanswered. There is also no return to the private message. Then I don't have five stars either.

Was this review helpful?

KM

Kush M.

Rating: 3.5 out of 5

a week ago

It would have been a good course if i have known all the topics of machine learning and deep learning before starting it. It does not teach you deep learning and machine learning in deep it is a course for projects though it helped me to understand the roadmap to solve certain problems.

Was this review helpful?

TH

Tejas H.

Rating: 4.5 out of 5

a month ago

Amazing Course with a Lot's of Hands ON Experience, I have successfully changed my carrer role to ML Engineer because of this course.

Thanks you very much for bring there.

Was this review helpful?

CJ

Cornelius Jesu J.

Rating: 3.5 out of 5

2 months ago

Course started too good.

1) It was new for me to join Discord, getting chance to interact and study together as people. This way of learning is new and very interesting for me.

2) Classes went without making us bored. tried to keep the session funfilled.

3) Content wise : Python basic, Pandas, Numpy, Matplotlib & Sklearn was very good session but after that course need to redone. there was multiple suggestions and bulldozer problem could have done in the way we were though in sklearn.

so 70% course was too good. remaining 30% need to be improved a lot. its not clear for very beginner persons like me.

Was this review helpful?

AB

Ankit B.

Rating: 4.5 out of 5

a month ago

A pedagogical course on data science and software development from the bottom-up. Thoroughly enjoyed it!

Was this review helpful?

FM

Filipe M.

Rating: 5.0 out of 5

3 days ago

I loved the course and leaving a 5 start mark. However I just wished it was a bit faster pace. A lot of time is going through google and that could be bypassed. Clearly the teacher knows the answer, so he could just give the answer. Also no point in doing a review of what we learned after from lesson to lesson. If someone wants to know what we learned on the previous lesson, just go back and learn. But apart from that, great course and very enthusiastic teacher. Very knowledgeable guy! Thanks!

Was this review helpful?

PC

Patricio Miguel C.

Rating: 5.0 out of 5

3 months ago

The course is very extensive and complete, it even comes with a Python introductory course! I love that it really puts in practice real-world scenarios.

Was this review helpful?

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**138. Machine Learning Model Evaluation**

Machine Learning Model Evaluation

Evaluating the results of a machine learning model is as important as building one.

But just like how different problems have different machine learning models, different machine learning models have different evaluation metrics.

Below are some of the most important evaluation metrics you'll want to look into for classification and regression models.

**Classification Model Evaluation Metrics/Techniques**

* **Accuracy** - The accuracy of the model in decimal form. Perfect accuracy is equal to 1.0.
* [**Precision**](https://scikit-learn.org/stable/modules/generated/sklearn.metrics.precision_score.html#sklearn.metrics.precision_score) - Indicates the proportion of positive identifications (model predicted class 1) which were actually correct. A model which produces no false positives has a precision of 1.0.
* [**Recall**](https://scikit-learn.org/stable/modules/generated/sklearn.metrics.recall_score.html#sklearn.metrics.recall_score) - Indicates the proportion of actual positives which were correctly classified. A model which produces no false negatives has a recall of 1.0.
* [**F1 score**](https://scikit-learn.org/stable/modules/generated/sklearn.metrics.f1_score.html#sklearn.metrics.f1_score) - A combination of precision and recall. A perfect model achieves an F1 score of 1.0.
* [**Confusion matrix**](https://www.dataschool.io/simple-guide-to-confusion-matrix-terminology/)- Compares the predicted values with the true values in a tabular way, if 100% correct, all values in the matrix will be top left to bottom right (diagonal line).
* [**Cross-validation**](https://scikit-learn.org/stable/modules/cross_validation.html) - Splits your dataset into multiple parts and train and tests your model on each part then evaluates performance as an average.
* [**Classification report**](https://scikit-learn.org/stable/modules/generated/sklearn.metrics.classification_report.html)- Sklearn has a built-in function called classification\_report() which returns some of the main classification metrics such as precision, recall and f1-score.
* [**ROC Curve**](https://scikit-learn.org/stable/modules/generated/sklearn.metrics.roc_score.html) - Also known as [receiver operating characteristic](https://en.wikipedia.org/wiki/Receiver_operating_characteristic) is a plot of true positive rate versus false-positive rate.
* [**Area Under Curve (AUC) Score**](https://scikit-learn.org/stable/modules/generated/sklearn.metrics.roc_auc_score.html)- The area underneath the ROC curve. A perfect model achieves an AUC score of 1.0.

**Which classification metric should you use?**

* **Accuracy** is a good measure to start with if all classes are balanced (e.g. same amount of samples which are labelled with 0 or 1).
* **Precision** and **recall** become more important when classes are imbalanced.
* If false-positive predictions are worse than false-negatives, aim for higher precision.
* If false-negative predictions are worse than false-positives, aim for higher recall.
* **F1-score** is a combination of precision and recall.
* A confusion matrix is always a good way to visualize how a classification model is going.

**Regression Model Evaluation Metrics/Techniques**

* [**R^2 (pronounced r-squared) or the coefficient of determination**](https://scikit-learn.org/stable/modules/generated/sklearn.metrics.r2_score.html) - Compares your model's predictions to the mean of the targets. Values can range from negative infinity (a very poor model) to 1. For example, if all your model does is predict the mean of the targets, its R^2 value would be 0. And if your model perfectly predicts a range of numbers it's R^2 value would be 1.
* [**Mean absolute error (MAE)**](https://scikit-learn.org/stable/modules/generated/sklearn.metrics.mean_absolute_error.html) - The average of the absolute differences between predictions and actual values. It gives you an idea of how wrong your predictions were.
* [**Mean squared error (MSE)**](https://scikit-learn.org/stable/modules/generated/sklearn.metrics.mean_squared_error.html) - The average squared differences between predictions and actual values. Squaring the errors removes negative errors. It also amplifies outliers (samples which have larger errors).

**Which regression metric should you use?**

* **R2** is similar to accuracy. It gives you a quick indication of how well your model might be doing. Generally, the closer your **R2** value is to 1.0, the better the model. But it doesn't really tell exactly how wrong your model is in terms of how far off each prediction is.
* **MAE** gives a better indication of how far off each of your model's predictions are on average.
* As for **MAE** or **MSE**, because of the way MSE is calculated, squaring the differences between predicted values and actual values, it amplifies larger differences. Let's say we're predicting the value of houses (which we are).
  + Pay more attention to MAE: When being $10,000 off is ***twice*** as bad as being $5,000 off.
  + Pay more attention to MSE: When being $10,000 off is ***more than twice*** as bad as being $5,000 off.

For more resources on evaluating a machine learning model, be sure to check out the following resources:

* [Scikit-Learn documentation for metrics and scoring (quantifying the quality of predictions)](https://scikit-learn.org/stable/modules/model_evaluation.html)
* [Beyond Accuracy: Precision and Recall by Will Koehrsen](https://towardsdatascience.com/beyond-accuracy-precision-and-recall-3da06bea9f6c)
* [Stack Overflow answer describing MSE (mean squared error) and RSME (root mean squared error)](https://stackoverflow.com/a/37861832)