MACHINE LEARNING ONDERZOEK

**CNN**

# Experiment 1

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| **Dataset grootte** | Voor segmentatie: 90 528   * Forward\_180: 19 368 * Backward\_180: 21 648 * Jump\_slow: 29 360 * Jump\_fast: 20 032 * Side\_swing: 41 128 * Cross\_over: 15 088   Na segmentatie: 1 740 |
| **Validatie set grootte** | 0.2 train test split |
| **window** | Trainingsset:   * 1 sec *~~overlap~~*   Validatieset:   * 1 sec *overlap* (50%) |
| **shuffle** | ja |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **CNN model** | model = Sequential()  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu', input\_shape=(n\_timesteps,n\_features)))  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu'))  model.add(Dropout(0.5))  model.add(MaxPooling1D(pool\_size=2))  model.add(Flatten())  model.add(Dense(64, input\_dim=3,  kernel\_regularizer=regularizers.l2(0.1),  activity\_regularizer=regularizers.l1(0.1)))  model.add(Dense(100, activation='relu'))  model.add(Dense(n\_outputs, activation='softmax')) |
| **History model fit** |  |
| **Model summary** |  |
| **Learning curve** |  |
| **Confusion matrix** |  |
| **accuraatheid** | 0.1667 |

# Experiment 2

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| --- | --- |
| **Dataset grootte** | Voor segmentatie: 90 528   * Forward\_180: 19 368 * Backward\_180: 21 648 * Jump\_slow: 29 360 * Jump\_fast: 20 032 * Side\_swing: 41 128 * Cross\_over: 15 088   Na segmentatie: 1 740 |
| **Validatie set grootte** | 0.2 train test split |
| **window** | Trainingsset:   * 1 sec *~~overlap~~*   Validatieset:   * 1 sec *overlap* (50%) |
| **shuffle** | \ |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **CNN model** | model = Sequential()  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu', input\_shape=(n\_timesteps,n\_features)))  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu'))  model.add(Dropout(0.5))  model.add(MaxPooling1D(pool\_size=2))  model.add(Flatten())  model.add(Dense(100, activation='relu'))  model.add(Dense(n\_outputs, activation='softmax')) |
| **History model fit** |  |
| **Model summary** |  |
| **Learning curve** |  |
| **Confusion matrix** |  |
| **accuraatheid** | loss: 0.3551 - accuracy: 0.8988 |
| **Scenario confusion matrix** |  |
| **accuraatheid** |  |

# Experiment 3: beter knippen signalen

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| **Dataset grootte** | Voor segmentatie: 90 528   * Forward\_180: 19 368 * Backward\_180: 21 648 * Jump\_slow: 29 360 * Jump\_fast: 20 032 * Side\_swing: 41 128 * Cross\_over: 15 088   Na segmentatie: 1 740 |
| **Validatie set grootte** | 0.2 train test split |
| **window** | Trainingsset:   * 1 sec *~~overlap~~*   Validatieset:   * 1 sec *overlap* (50%) |
| **shuffle** | \ |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **CNN model** | model = Sequential()  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu', input\_shape=(n\_timesteps,n\_features)))  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu'))  model.add(Dropout(0.5))  model.add(MaxPooling1D(pool\_size=2))  model.add(Flatten())  model.add(Dense(100, activation='relu'))  model.add(Dense(n\_outputs, activation='softmax')) |
| **History model fit** |  |
| **Model summary** |  |
| **Learning curve** |  |
| **Confusion matrix** |  |
| **accuraatheid** |  |
| **Scenario confusion matrix** |  |
| **accuraatheid** |  |

# Experiment 4: verhogen window

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| **Dataset grootte** | Voor segmentatie: 90 528   * Forward\_180: 19 368 * Backward\_180: 21 648 * Jump\_slow: 29 360 * Jump\_fast: 20 032 * Side\_swing: 41 128 * Cross\_over: 15 088   Na segmentatie: 1 740 |
| **Validatie set grootte** | 0.2 train test split |
| **window** | Trainingsset:   * 1.5 sec *~~overlap~~*   Validatieset:   * 1.5 sec *overlap* (50%) |
| **shuffle** | \ |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **CNN model** | model = Sequential()  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu', input\_shape=(n\_timesteps,n\_features)))  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu'))  model.add(Dropout(0.5))  model.add(MaxPooling1D(pool\_size=2))  model.add(Flatten())  model.add(Dense(100, activation='relu'))  model.add(Dense(n\_outputs, activation='softmax')) |
| **History model fit** |  |
| **Model summary** |  |
| **Learning curve** |  |
| **Confusion matrix** |  |
| **accuraatheid** | loss: 0.3213 - accuracy: 0.8826 |
| **Scenario confusion matrix** |  |
| **accuraatheid** |  |

# Experiment 5: validationset + window

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| --- | --- |
| **Dataset grootte** | Voor segmentatie: 90 528   * Forward\_180: 19 368 * Backward\_180: 21 648 * Jump\_slow: 29 360 * Jump\_fast: 20 032 * Side\_swing: 41 128 * Cross\_over: 15 088   Na segmentatie: 1 740 |
| **Validatie set grootte** | 32 |
| **window** | Trainingsset:   * 2 sec *~~overlap~~*   Validatieset:   * 2 sec *overlap* (50%) |
| **shuffle** | \ |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **CNN model** | model = Sequential()  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu', input\_shape=(n\_timesteps,n\_features)))  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu'))  model.add(Dropout(0.5))  model.add(MaxPooling1D(pool\_size=2))  model.add(Flatten())  model.add(Dense(100, activation='relu'))  model.add(Dense(n\_outputs, activation='softmax')) |
| **History model fit** |  |
| **Model summary** |  |
| **Learning curve** |  |
| **Confusion matrix** |  |
| **accuraatheid** | loss: 2.1211 - accuracy: 0.5938 |

# Experiment 6: overlap

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| **Dataset grootte** | Voor segmentatie: 90 528   * Forward\_180: 19 368 * Backward\_180: 21 648 * Jump\_slow: 29 360 * Jump\_fast: 20 032 * Side\_swing: 41 128 * Cross\_over: 15 088   Na segmentatie: 1 740 |
| **Validatie set grootte** | 32 |
| **window** | Trainingsset:   * 2 sec *overlap* (50%)   Validatieset:   * 2 sec *overlap* (50%) |
| **shuffle** | \ |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **CNN model** | model = Sequential()  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu', input\_shape=(n\_timesteps,n\_features)))  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu'))  model.add(Dropout(0.5))  model.add(MaxPooling1D(pool\_size=2))  model.add(Flatten())  model.add(Dense(100, activation='relu'))  model.add(Dense(n\_outputs, activation='softmax')) |
| **History model fit** |  |
| **Model summary** |  |
| **Learning curve** |  |
| **Confusion matrix** |  |
| **accuraatheid** | loss: 2.8803 - accuracy: 0.5000 |

# Experiment 7: overlap

|  |  |
| --- | --- |
| **Dataset grootte** | Voor segmentatie: 90 528   * Forward\_180: 19 368 * Backward\_180: 21 648 * Jump\_slow: 29 360 * Jump\_fast: 20 032 * Side\_swing: 41 128 * Cross\_over: 15 088   Na segmentatie: 1 740 |
| **Validatie set grootte** | 16 |
| **window** | Trainingsset:   * 2 sec *overlap* (70%)   Validatieset:   * 2 sec *~~overlap~~* (0%) |
| **shuffle** | \ |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **CNN model** | model = Sequential()  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu', input\_shape=(n\_timesteps,n\_features)))  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu'))  model.add(Dropout(0.5))  model.add(MaxPooling1D(pool\_size=2))  model.add(Flatten())  model.add(Dense(100, activation='relu'))  model.add(Dense(n\_outputs, activation='softmax')) |
| **History model fit** |  |
| **Model summary** |  |
| **Learning curve** |  |
| **Confusion matrix** |  |
| **accuraatheid** | loss: 2.5431 - accuracy: 0.5000 |

# Experiment 8: zonder forward en backward 180

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| --- | --- |
| **Dataset grootte** | Voor segmentatie: 90 528   * Jump\_slow: 29 360 * Jump\_fast: 20 032 * Side\_swing: 41 128 * Cross\_over: 15 088   Na segmentatie: 1 740 |
| **Validatie set grootte** | 16 |
| **window** | Trainingsset:   * 2 sec *overlap* (70%)   Validatieset:   * 2 sec *~~overlap~~* (0%) |
| **shuffle** | \ |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **CNN model** | model = Sequential()  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu', input\_shape=(n\_timesteps,n\_features)))  model.add(Conv1D(filters=64, kernel\_size=3, activation='relu'))  model.add(Dropout(0.5))  model.add(MaxPooling1D(pool\_size=2))  model.add(Flatten())  model.add(Dense(100, activation='relu'))  model.add(Dense(n\_outputs, activation='softmax')) |
| **History model fit** |  |
| **Model summary** |  |
| **Learning curve** |  |
| **Confusion matrix** |  |
| **accuraatheid** | loss: 0.8272 - accuracy: 0.7143 |

**SVC**

# Experiment 1

|  |  |
| --- | --- |
| **Dataset grootte** | Na segmentatie: 3408   * Forward\_180: 744 * Backward\_180: 832 * Jump\_slow: 1128 * Jump\_fast: 760 * Side\_swing: 1616 * Cross\_over: 568 |
| **Validatie set grootte** | 0.2 train test split |
| **window** | Trainingsset:   * 1 sec *overlap* (50%) |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **Dimension reduction** | 6 |
| **gridsearch** | {'C': [0.1,1, 10, 100],  'gamma': [1,0.1,0.01,0.001],  'kernel': ['linear','rbf', 'poly', 'sigmoid']} |
| **Confusion matrix** |  |
| **accuraatheid** | Training set score: 0.675  Test set score: 0.662 |
| **Scenario confusion matrix** |  |
| **accuraatheid** | Test set score: 0.175 |

**LinearSVC**

# Experiment 1

|  |  |
| --- | --- |
| **Dataset grootte** | Na segmentatie: 3408   * Forward\_180: 744 * Backward\_180: 832 * Jump\_slow: 1128 * Jump\_fast: 760 * Side\_swing: 1616 * Cross\_over: 568 |
| **Validatie set grootte** | 0.2 train test split |
| **window** | Trainingsset:   * 1 sec *overlap* (50%) |
| **Dimension reduction** | 6 |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **gridsearch** | {'C': [0.1,1, 10, 100]} |
| **Confusion matrix** |  |
| **accuraatheid** | Training set score: 0.615  Test set score: 0.604 |

**Random Forest**

# Experiment 1

|  |  |
| --- | --- |
| **Dataset grootte** | Na segmentatie: 3408   * Forward\_180: 744 * Backward\_180: 832 * Jump\_slow: 1128 * Jump\_fast: 760 * Side\_swing: 1616 * Cross\_over: 568 |
| **Validatie set grootte** | 0.2 train test split |
| **window** | Trainingsset:   * 1 sec *overlap* (50%) |
| **Dimension reduction** | 6 |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **gridsearch** | {'n\_estimators': [100, 1000]} |
| **Confusion matrix** |  |
| **accuraatheid** | Training set score: 1.000  Test set score: 0.746 |

**AdaBoost**

# Experiment 1

|  |  |
| --- | --- |
| **Dataset grootte** | Na segmentatie: 3408   * Forward\_180: 744 * Backward\_180: 832 * Jump\_slow: 1128 * Jump\_fast: 760 * Side\_swing: 1616 * Cross\_over: 568 |
| **Validatie set grootte** | 0.2 train test split |
| **window** | Trainingsset:   * 1 sec *overlap* (50%) |
| **Dimension reduction** | 6 |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **gridsearch** | {'learning\_rate': np.arange(0.10, 1, 0.2),  'n\_estimators': [10, 50, 100, 1000],  'base\_estimator': [RandomForestClassifier(), ExtraTreesClassifier()]} |
| **Confusion matrix** |  |
| **accuraatheid** | Training set score: 1.000  Test set score: 0.750 |

**Naive Bayes**

# Experiment 1

|  |  |
| --- | --- |
| **Dataset grootte** | Na segmentatie: 3408   * Forward\_180: 744 * Backward\_180: 832 * Jump\_slow: 1128 * Jump\_fast: 760 * Side\_swing: 1616 * Cross\_over: 568 |
| **Validatie set grootte** | 0.2 train test split |
| **window** | Trainingsset:   * 1 sec *overlap* (50%) |
| **Dimension reduction** | 6 |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **gridsearch** | / |
| **Confusion matrix** |  |
| **accuraatheid** | Training set score: 1.000  Test set score: 0.750 |

**Kneighbors**

# Experiment 1

|  |  |
| --- | --- |
| **Dataset grootte** | Na segmentatie: 3408   * Forward\_180: 744 * Backward\_180: 832 * Jump\_slow: 1128 * Jump\_fast: 760 * Side\_swing: 1616 * Cross\_over: 568 |
| **Validatie set grootte** | 0.2 train test split |
| **window** | Trainingsset:   * 1 sec *overlap* (50%) |
| **Dimension reduction** | 6 |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **gridsearch** | {'n\_neighbors': [1,2,4,8,10],  'weights': ['uniform', 'distance'],  'algorithm': ['ball\_tree', 'kd\_tree', 'brute']} |
| **Confusion matrix** |  |
| **accuraatheid** | Training set score: 0.650  Test set score: 0.592 |

**SGD**

# Experiment 1

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| --- | --- |
| **Dataset grootte** | Na segmentatie: 3408   * Forward\_180: 744 * Backward\_180: 832 * Jump\_slow: 1128 * Jump\_fast: 760 * Side\_swing: 1616 * Cross\_over: 568 |
| **Validatie set grootte** | 0.2 train test split |
| **window** | Trainingsset:   * 1 sec *overlap* (50%) |
| **Dimension reduction** | 6 |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **gridsearch** | {'alpha': [1e-7, 1e-6, 1e-5, 1e-4, 1e-3, 1e-2, 1e-1],  'learning\_rate': ['constant', 'optimal', 'invscaling', 'adaptive'],  'max\_iter': [10, 100, 1000], #np.ceil(10\*\*6 / n)  'shuffle' : [True],  'eta0' : [1]} |
| **Confusion matrix** |  |
| **accuraatheid** | Training set score: 0.618  Test set score: 0.592 |

**MLP**

# Experiment 1

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| --- | --- |
| **Dataset grootte** | Na segmentatie: 3408   * Forward\_180: 744 * Backward\_180: 832 * Jump\_slow: 1128 * Jump\_fast: 760 * Side\_swing: 1616 * Cross\_over: 568 |
| **Validatie set grootte** | 0.2 train test split |
| **window** | Trainingsset:   * 1 sec *overlap* (50%) |
| **Dimension reduction** | 6 |
| **Klassen** | Jump\_fast  Jump\_slow  Side\_swing  Cross\_over  Forward\_180  Backward\_180 |
| **gridsearch** | / |
| **Confusion matrix** |  |
| **accuraatheid** | Training set score: 0.670  Test set score: 0.643 |