## Customer Requirements Speciﬁcation

**SAG ML TextRecog CRS ــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــــ**

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# Document Status:

|  |  |  |
| --- | --- | --- |
| **Name** | PO\_SAG\_CRS\_ML\_Text\_Recog | |
| Version | V1.4 | |
| Status | Released | |
| Author | AA | |
| Date | [20-11-2022] | |
| Team approval | MEQ | Approved |
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| Final approval | EA | Approved |

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# Document History:

|  |  |  |  |
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| **Version** | **Author** | **Date** | **Change** |
| 1.0 | AA | [8-11-2022] | * Initial Creation * Add CRS Requirements |
| 1.1 | EID | [13-11-2022] | * Edit The Document Title. * Edit the Reference Document version. * Edit the Project Definition, Features , Key Elements and Requirements. |
| 1.2 | EID | [14-11-2022] | * Edit System Context * Edit some Key Elements. |
| 1.3 | AA | [18-11-2022] | * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_001 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_002 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_003 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_004 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_005 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_006 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_007 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_008 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_009 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_010 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_011 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_012 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_013 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_014 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_015 * PO\_ٍSAG\_CRS\_ML\_ObjRecog\_Review\_016 |
| 1.4 | AA | [20-11-2022] | * PO\_ٍSAG\_CRS\_ML\_Text\_Recog\_Review\_017 * PO\_ٍSAG\_CRS\_ML\_Text\_Recog\_Review\_018 |

# Reference Document:

|  |  |  |  |
| --- | --- | --- | --- |
| **Ref.number** | **Doc.Name** | **Version** | **Status** |
| 1 | PO\_SAG\_CR\_ML | V1.4 | Released |

# Project Description:

## Definition:

The Text Recognition is the conversion of images of typed, handwritten, or printed text into machine-encoded text, whether from a scanned document, a photo of a document, a scene-photo (for example the text on signs and billboards in a landscape photo) or from subtitle text superimposed on an image.

## Features:

* Text Recognition.

## Key Elements:

* The Text Recognition model shall recognize text including handwritten on other objects (book, paper, sign, etc.).

# System Context:

Diagram

Description automatically generated



## CRS Requirements:

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| --- | --- | --- | --- |
| **Req\_ID** | Req\_SAG\_CRS\_ML\_Text\_Recog\_***001***-V1.3 | **Covers** | PO\_SAG\_CR\_ML\_004-V1.1 |
| **Description** | The Text\_Recog\_Class class shall take the Input\_ Frames and convert them to gray-scale images. | | |

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| **Req\_ID** | Req\_SAG\_CRS\_ML\_Text\_Recog\_***002***-V1.3 | **Covers** | PO\_SAG\_CR\_ML\_004-V1.1 |
| **Description** | The Text\_Recog\_Class shall call a resizing algorithm to resize each image and expand its dimension to make it compatible with the input shape of architecture. | | |

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| **Req\_ID** | Req\_SAG\_CRS\_ML\_Text\_Recog\_***003***-V1.3 | **Covers** | PO\_SAG\_CR\_ML\_004-V1.1 |
| **Description** | The Text\_Recog\_Class shall call a normalization algorithm to normalize the image pixel values by dividing it with 255. | | |

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| **Req\_ID** | Req\_SAG\_CRS\_ML\_Text\_Recog\_***004***-V1.3 | **Covers** | PO\_SAG\_CR\_ML\_004-V1.1 |
| **Description** | The Text\_Recog\_Class shall call an encoding algorithm to encode each character of a word into some numerical value. | | |

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| **Req\_ID** | Req\_SAG\_CRS\_ML\_Text\_Recog\_***005***-V1.2 | **Covers** | PO\_SAG\_CR\_ML\_004-V1.1 |
| **Description** | The Text\_Recog\_Class shall use the CNN architecture to process each image to extract the INN\_CharFeatureMap. | | |

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| **Info\_id** | Info\_PO\_SAG\_CRS\_ML\_Text\_Recog \_***001***-V1.0 |
| **Description** | The INN\_CharFeatureMap is an inner signal from the CNN layer and it represents the feature maps for the letters. |

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| **Req\_ID** | Req\_SAG\_CRS\_ML\_Text\_Recog\_***006***-V1.2 | **Covers** | PO\_SAG\_CR\_ML\_004-V1.1 |
| **Description** | The Text\_Recog\_Class shall use bidirectional-LSTM to take the INN\_CharFeatureMap and output INN\_SoftMaxProbablities. | | |

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| **Info\_id** | Info\_PO\_SAG\_CRS\_ML\_Text\_Recog \_***002***-V1.0 | |
| **Description** | The INN\_SoftMaxProbablities is an inner signal that the bidirectional-LSTM outputs and it represents the SoftMax probabilities over the vocabulary. |

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| **Req\_ID** | Req\_SAG\_CRS\_ML\_Text\_Recog\_***007***-V1.1 | **Covers** | PO\_SAG\_CR\_ML\_004-V1.1 |
| **Description** | The Text\_Recog\_Class shall use the CTC decoder to get the INN\_SoftMaxProbablities from different time steps to get the raw text. | | |

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| **Req\_ID** | Req\_SAG\_CRS\_ML\_Text\_Recog\_***008***-V1.1 | **Covers** | PO\_SAG\_CR\_ML\_004-V1.1 |
| **Description** | The Text\_Recog\_Class shall use a formatter to get the Output\_Audio\_Files\_Text\_Recog. | | |

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| **Req\_ID** | Req\_SAG\_CRS\_ML\_Text\_Recog\_***009***-V1.1 | **Covers** | PO\_SAG\_CR\_ML\_004-V1.1 |
| **Description** | The Text\_Recog\_Class shall return the Output\_Audio\_Files\_Text\_Recog to the ECU. | | |