Table S3. Machine learning studies that classified AD or MCI and healthy controls

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Reference | Dataset | Classification | Image features | Additional imaging | Classifiers | Results |
|  |  | tasks (n) | (FS and representation) | sequences and features |  |  |
| (Aggarwal, Rana et al. 2015) | OASIS | HC vs AD (99 / 99) | 3D-DWT (symmlet) of 7 ROI’s: hip- | n.a. | kNN | Sen = 0.789 / Spe = 0.810 |
|  |  |  | pocampus, amygdalae, ventricles, an- |  |  |  |
|  |  |  | terior and posterior cingulate (FS by |  |  |  |
|  |  |  | FDR and mRMR). |  |  |  |
| (Aguilar, Westman et al. 2013) | AddNeuroMed | HC vs AD (110 / 116) | 68 cortical thickness values and | Education. | SVM (non-lin) | Sen = 0.862 / Spe = 0.900 |
|  |  | MCInc vs MCIc (98 / 21) | 50 regional volumes obtained with | n.a. | OPLS | Sen = 0.810 / Spe = 0.684 |
|  |  |  | FreeSurfer. |  |  |  |
| (Ahmed, Mizotin et al. 2015) | ADNI | HC vs AD (162 / 137) | Circular harmonic features extracted | n.a. | SVM (RBF) | Sen = 0.791 / Spe = 0.882 |
|  |  | HC vs MCI (162 / 210) | from hippocampus and posterior cingu- |  |  | Sen = 0.626 / Spe = 0.748 |
|  |  | AD vs MCI (210 / 137) | late cortex (FS by PCA; BoW represen- |  |  | Sen = 0.490 / Spe = 0.752 |
|  |  |  | tation) |  |  |  |
| (Anagnostopoulos, Giannoukos et al. 2013) | AddNeuroMed | HC vs MCI vs AD | Cortical volume and thickness for spe- | T2w, demographics. | Ensemble of | Acc = 0.771 |
|  |  | (113 / 122 / 123) | cific ROI’s, manual volume measure- |  | FF-NN, SVM, |  |
|  |  |  | ment of the hippocampus. |  | PESFAM, |  |
|  |  |  |  |  | P-NN, kNN |  |
| (Archana and Ramakrishnan 2014) | OASIS | HC vs AD (92 / 45) | Voxel-wise texture features from struc- | n.a. | SVM | Sen = 0.877 / Spe = 0.849 |
|  |  | HC vs MCI (92 / 67) | ture tensor analysis (FS by FDR). |  |  | Sen = 0.764 / Spe = 0.783 |
|  |  | AD vs MCI (67 / 45) |  |  |  | Sen = 0.747 / Spe = 0.767 |
| (Babu, Suresh et al. 2013) | ADNI | HC vs MCIc (232 / 167) | Voxel-wise GM probability values from | n.a. | RBF-NN | Sen = 0.730 / Spe = 0.840 |
|  |  | MCInc vs MCIc (236 / 167) | VBM analysis (FS by t-test). |  |  | Sen = 0.880 / Spe = 0.890 |
| (Beheshti, Demirel et al. 2015) | ADNI | HC vs AD (130 / 130) | Voxel-wise GM probability values from | n.a. | SVM (RBF) | Sen = 0.908 / Spe = 0.908 |
|  |  |  | VBM analysis (FS based on PDF of |  |  |  |
|  |  |  | ROI’s). |  |  |  |
| (Casanova, Hsu et al. 2013) | ADNI | HC vs AD (188 / 171) | Voxel-wise intensities from GM, WM | n.a. | Regularized | Sen = 0.843 / Spe = 0.890 |
|  |  | HC vs MCInc (188 / 182) | and CSF maps. | n.a. | logistic | Sen = 0.586 / Spe = 0.681 |
|  |  | HC vs MCIc (188 / 153) |  | n.a. | regression | Sen = 0.740 / Spe = 0.881 |
|  |  | MCInc vs MCIc (182 / 153) |  | Cognitive scores. |  | Sen = 0.579 / Spe = 0.701 |
| (Chaddad, Desrosiers et al. 2016) | OASIS | HC vs AD (62 / 62) | 3D co-occurrence matrix. | n.a. | Random forest. | Sen = 0.742 / Spe = 0.759 |
| (Chen and Pham 2013) | OASIS | HC vs AD (75 / 75) | 2D regularity information from semi- | n.a. | HMM | Sen = 0.800 / Spe = 0.800 |
|  |  |  | variogram analysis of GM maps. |  |  |  |
| (Chen, Wei et al. 2015) | ADNI | MCInc vs MCIc (167 / 236) | GM volumes in 93 ROI’s (sparse repre- | n.a. | SRC | Sen = 0.581 / Spe = 0.763 |
|  |  |  | sentation). |  |  |  |
| (Chincarini, Bosco et al. 2011) | ADNI | HC vs AD (189 / 144) | Voxel intensities of filtered masks in 9 | n.a. | Random | Sen = 0.890 / Spe = 0.940 |
|  |  | HC vs MCIc (189 / 136) | ROI’s: hippocampi, amygdalae. middle |  | forest + SVM | Sen = 0.890 / Spe = 0.800 |
|  |  | MCInc vs MCIc (166 / 136) | and inf temp gyri, rolandic. |  |  | Sen = 0.720 / Spe = 0.650 |
| (Cho, Seong et al. 2012) | ADNI | HC vs AD (80 / 66) | Cortical thickness values (FS by PCA). | n.a. | LDA | Sen = 0.820 / Spe = 0.930 |
|  |  | HC vs MCIc (80 / 35) |  |  |  | Sen = 0.660 / Spe = 0.890 |
|  |  | MCInc vs MCIc (66 / 35) |  |  |  | Sen = 0.630 / Spe = 0.760 |
| (Costafreda, Dinov et al. 2011) | AddNeuroMed | MCInc vs MCIc (81 / 22) | Thickness values of hippocampi. | n.a. | SVM (RBF) | Sen = 0.770 / Spe = 0.800 |
| (Coupé, Fonov et al. 2015) | ADNI | MCInc vs MCIc (309 / 37) | SNIPE (Scoring by Nonlocal Image | n.a. | LDA | Sen = 0.649 / Spe = 0.735 |
|  |  |  | Patch Estimator) hippocampal fea- |  |  |  |
|  |  |  | tures. |  |  |  |
| (Cui, Wen et al. 2012) | Local | HC vs MCI (204 / 79) | 10 regional volumes from T1w, 58 WM | DTI. | SVM (RBF) | Sen = 0.520 / Spe = 0.784 |
|  |  |  | integrity features from DTI. |  |  |  |
| (Cuingnet, Gerardin et al. 2011) | ADNI | HC vs AD (80 / 66) | Voxel-wise GM probability values in | n.a. | SVM (linear) | en = 0.810 / Spe = 0.950 |
|  |  | HC vs MCIc (80 / 35) | ROI’s defined by different processing |  |  | Sen = 0.680 / Spe = 0.950 |
|  |  | MCInc vs MCIc (66 / 35) | pipelines. |  |  | Sen = 0.570 / Spe = 0.780 |
| (Cuingnet, Glaunes et al. 2013) | ADNI | HC vs AD (81 / 68) | GM, WM and CSF probability maps, | n.a. | SVM (non-lin) | Sen = 0.880 / Spe = 0.930 |
|  |  |  | cortical thickness values (FS by |  |  |  |
|  |  |  | anatomical and spatial priors in SVM). |  |  |  |
| (Davatzikos, Bhatt et al. 2011) | ADNI | MCInc vs MCIc (85 / 35) | Pattern of atrophy in GM and WM | CSF biomarkers. | SVM (non-lin) | Sen = 0.842 / Spe = 0.512 |
|  |  |  | maps. |  |  |  |
| (Ding, Zhang et al. 2015) | ADNI | HC vs AD (58 / 54) | 8 GM volumes in ROI’s, 220 texture | n.a. | SVM | Sen = 0.870 / Spe = 0.983 |
|  |  |  | features, 64 features from 2D multi- |  |  |  |
|  |  |  | scale Gabor filtering (FS by RFE). |  |  |  |
| (Dubey, Zhou et al. 2014) | ADNI | HC vs AD (191 / 138) | Cortical thickness values, volumes of | n.a. | Random forest | Sen = 0.826 / Spe = 0.906 |
|  |  | HC vs MCI (191 / 319) | cortical ROI’s, volumes of WM in |  | SVM | Sen = 0.793 / Spe = 0.493 |
|  |  | HC vs AD+MCIc (191 / 280) | ROI’s, total surface area of the cortex |  | SVM | Sen = 0.879 / Spe = 0.825 |
|  |  |  | (FS by sparse logistic regression). |  |  |  |
| (Dyrba, Ewers et al. 2012) | Local | HC vs AD (143 / 137) | GM probability map values (FS by | n.a. | SVM (RBF) | Sen = 0.874 / Spe = 0.912 |
|  |  |  | entropy-based information gain). |  |  |  |
| (Eskildsen, Coupé et al. 2013) | ADNI | HC vs AD (226 / 194) | Cortical thickness values (FS by t-test | Age. | LDA | Sen = 0.794 / Spe = 0.889 |
|  |  | MCInc vs MCIc (227 / 161) | and mRMR). |  |  | Sen = 0.658 / Spe = 0.683 |
| (Eskildsen, Coupé et al. 2015) | ADNI | MCInc vs MCIc (238 / 167) | L / R hippocampal grading, cortical | Age. | LDA | Sen = 0.696 / Spe = 0.736 |
|  |  |  | thickness values of 3 ROI’s (FS by mu- |  |  |  |
|  |  |  | tual information method). |  |  |  |
| (Filipovych, Davatzikos et al. 2011) | ADNI | HC vs AD (63 / 54) | GM RAVENS map (FS by RFE). | n.a. | SVM (linear, | Sen = 0.796 / Spe = 0.857 |
|  |  | MCInc vs MCIc (174 / 68) |  |  | semi-supervised) | Sen = 0.794 / Spe = 0.517 |
| (Granziera, Daducci et al. 2015) | Local | HC vs MCI (77 / 42) | Volume and mean intensity values from | MTI, T2\*. | SVM | Sen = 0.600 / Spe = 0.830 |
|  |  |  | 7 ROI’s (WM and cortical GM, tha- |  |  |  |
|  |  |  | lamus, caudate, globus pallidus, puta- |  |  |  |
|  |  |  | men and hippocampus) and for WM |  |  |  |
|  |  |  | and GM of each lobe. |  |  |  |
| (Gray, Aljabar et al. 2013) | ADNI | HC vs MCI (35 / 75) | 83 ROI volumes from GM maps, voxel | PET, APOE3, | Random | Sen = 0.775 / Spe = 0.679 |
|  |  |  | intensities from PET. | CSF biomarkers. | forest |  |
| (Guerrero, Wolz et al. 2014) | ADNI | HC vs AD (175 / 106) | Voxel intensities (Laplacian eigenmaps | n.a. | SVM (linear) | Sen = 0.860 / Spe = 0.850 |
|  | ADNI-GO | MCInc vs MCIc (114 / 116) | representation after FS by Elastic Net |  |  | Sen = 0.750 / Spe = 0.670 |
|  |  | HC vs MCIc (175 / 116) | and manifold learning). |  |  | Sen = 0.860 / Spe = 0.760 |
|  |  | HC vs MCIe (134 / 229) |  |  |  | Sen = 0.610 / Spe = 0.690 |
| (Herrera, Rojas et al. 2013) | ADNI | HC vs AD (443 / 459) | 2D-DWT (Db4 and Haar) multi-scale | n.a. | SVM (RBF) | Sen = 0.963 / Spe = 0.961 |
|  |  | HC vs MCI vs AD (443 | features (FS by PCA and mutual infor- |  |  | Acc = 0.774 |
|  |  | / 448 / 459) | mation method). |  |  |  |
| (Hinrichs, Singh et al. 2009) | ADNI | HC vs AD (94 / 89) | GM probability maps (FS by t-test to | n.a. | Linear | Sen = 0.850 / Spe = 0.800 |
|  |  |  | select relevant voxels). |  | programming |  |
| (Hinrichs, Singh et al. 2011) | ADNI | HC vs AD (66 / 48) | GM probability maps (FS by t-test to | PET, APOE3, | MKL | Sen = 0.867 / Spe = 0.966 |
|  |  |  | select relevant voxels). | CSF biomarkers, |  |  |
|  |  |  |  | cognitive scores. |  |  |
| (Hor and Moradi 2016) | ADNI | HC vs MCIc (178 / 96) | Volume measurements of six ROI’s | n.a. | Random | Sen = 0.691 / Spe = 0.844 |
|  |  | HC vs MCInc (178 / 126) | (ventricles, hippocampus, whole-brain, | n.a. | forest | Sen = 0.734 / Spe = 0.863 |
|  |  | HC vs MCInc (18 / 144) | entorhinal, fusiform and mid-temporal) | PET. |  | Sen = 0.737 / Spe = 0.897 |
|  |  | MCInc vs MCIc (126 / 96) | and ICV from T1w, FDG and AV45 up- | n.a. |  | Sen = 0.819 / Spe = 0.750 |
|  |  | MCInc vs MCIc (144 / 27) | take values from PET (FS by informa- | PET. |  | Sen = 0.831 / Spe = 0.803 |
|  |  |  | tion gain). |  |  |  |
| (Hu, Wang et al. 2016) | ADNI | HC vs AD (228 / 188) | 3D-DWT (Gabor and Haar) multi-scale | n.a. | SVM (linear) | Sen = 0.846 / Spe = 0.855 |
|  |  | MCInc vs MCIc (62 / 71) | features from GM of map of hippocam- |  |  | Sen = 0.718 / Spe = 0.823 |
|  |  |  | pus. |  |  |  |
| (Illan, Garriz et al. 2014) | ADNI | HC vs AD (76 / 63) | Binary values of GM, WM maps in 6 | n.a. | SVM (ensemble) | Sen = 0.926 / Spe = 0.845 |
|  |  | HC vs MCIc (76 / 110) | ROI’s: parahippocampal gyrus, lingual |  |  | Sen = 0.773 / Spe = 0.845 |
|  |  |  | gyrus, hippocampus, frontal lobe, pre- |  |  |  |
|  |  |  | central gyrus, temporal lobe (Bayesian |  |  |  |
|  |  |  | network representation). |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- |
| Reference | Dataset | Classification | Image features | Additional imaging | Classifiers | Results |
|  |  | tasks (n) | (FS and representation) | sequences and features |  |  |
| (Jiang and Shi 2014) | ADNI | HC vs AD (52 / 51) | 83 ROI volumes from GM maps (FS by | n.a. | kNN | Sen = 0.920 / Spe = 0.904 |
|  |  |  | sparse kernel entropy component anal- |  |  |  |
|  |  |  | ysis). |  |  |  |
| (Jie, Zhang et al. 2014) | ADNI | HC vs AD (52 / 51) | GM volumes and PET intensity values | PET, | MKL | Sen = 0.947 / Spe = 0.958 |
|  |  | HC vs MCI (52 / 99) | in 93 ROI’s(FS by manifold regularized | CSF biomarkers. |  | Sen = 0.894 / Spe = 0.708 |
|  |  |  | multitask learning method). |  |  |  |
| (Khedher, Ramirez et al. 2015) | ADNI | HC vs AD (229 / 188) | Voxel intensities in GM and WM maps | n.a. | SVM (linear) | Sen = 0.913 / Spe = 0.851 |
|  |  | HC vs MCI (229 / 401) | (FS by partial least square). |  |  | Sen = 0.822 / Spe = 0.816 |
|  |  | MCI vs AD (401 / 188) |  |  |  | Sen = 0.870 / Spe = 0.838 |
| (Komlagan, Ta et al. 2014) | ADNI | MCInc vs MCIc (236 / 166) | SNIPE (Scoring by Nonlocal Image | n.a. | SVM (linear) | Sen = 0.615 / Spe = 0.856 |
|  |  |  | Patch Estimator) hippocampal features |  |  |  |
|  |  |  | (FS by sparse logistic regression). |  |  |  |
| (Korolev, Symonds et al. 2016) | ADNI | MCInc vs MCIc (139 / 120) | Cortical thickness, volumes, curvature | Risk factors, | MKL | Sen = 0.834 / Spe = 0.764 |
|  |  |  | and surface area of 180 ROI’s (FS by | cognitive scores, |  |  |
|  |  |  | joint mutual information criterion). | proteomic data. |  |  |
| (Krashenyi, Ramirez et al. 2016) | ADNI | HC vs AD (229 / 188) | Mean ROI intensity values of GM and | PET. | Fuzzy inference | Sen = 0.933 / Spe = 0.922 |
|  |  | HC vs MCI (229 / 401) | WM maps from T1w and mean inten- |  | system. | Sen = 0.759 / Spe = 0.861 |
|  |  | MCI vs AD (401 / 188) | sity from PET (FS by t-test). |  |  | Sen = 0.749 / Spe = 0.820 |
| (Lebedev, Westman et al. 2014) | ADNI | HC vs AD (75 / 35) | Volumes from 41 ROI’s and corti- | APOE3, | Random | Sen = 0.920 / Spe = 0.886 |
|  |  | MCInc vs MCIc (130 / 35) | cal thickness values (FS by PCA and | demographics. | forest. | Sen = 0.833 / Spe = 0.813 |
|  |  |  | RFE). |  |  |  |
| (Li, Wang et al. 2010) | OASIS | HC vs MCI (80 / 89) | GM values in 19 ROI’s (FS by t-test | MMSE. | SVM (RBF) | Sen = 0.919 / Spe = 0.880 |
|  |  |  | and feature ranking). |  |  |  |
| (Li, Liu et al. 2014) | ADNI | MCIc vs MCInc (161 / 132) | Cortical thickness values, volumes of | Demographics, | Random | Sen = 0.667 / Spe = 0.814 |
|  |  |  | cortical ROI’s, volumes of WM in | genetic data, | forest |  |
|  |  |  | ROI’s, total surface area of the cortex | cognitive scores, |  |  |
|  |  |  | (FS by hierarchical Lasso method). | lab tests. |  |  |
| (Li, Oishi et al. 2014) | ADNI | HC vs AD (142 / 80) | Voxel-wise combination of 2D-LBP | n.a. | SVM | Sen = 0.804 / Spe = 0.827 |
|  |  | MCInc vs MCIc (142 / 141) | from axial, coronal and sagittal orienta- |  |  | Sen = 0.615 / Spe = 0.635 |
|  |  |  | tions (FS by t-test and a priori knowl- |  |  |  |
|  |  |  | edge). |  |  |  |
| (Li, Yan et al. 2015) | ADNI | HC vs AD (60 / 60) | Volume and 15 texture features from 4 | n.a. | SVM (RBF) | Sen = 0.927 / Spe = 0.973 |
|  |  | HC vs MCI (60 / 60) | structures (GM, WM, CSF, hippocam- |  |  | Sen = 0.804 / Spe = 0.864 |
|  |  |  | pus) in L / R hemispheres (FS by chain- |  |  |  |
|  |  |  | like agent genetic algorithm). |  |  |  |
| (Liu, Suk et al. 2013) | ADNI | HC vs AD (198 / 198) | Volume and cortical thickness from 68 | n.a. | SVM | Sen = 0.894 / Spe = 0.950 |
|  |  | HC vs MCI (198 / 198) | ROI’s (sparse representation and high- |  | (multi-kernel) | Sen = 0.778 / Spe = 0.854 |
|  |  |  | order graph matching for FS). |  |  |  |
| (Liu, Tosun et al. 2013) | ADNI | HC vs MCIc (138 / 97) | Values of volume from 94 ROI’s and | n.a. | Logistic | Sen = 0.650 / Spe = 0.630 |
|  |  | HC vs MCInc (138 / 93) | cortical thickness from 68 ROI’s (repre- |  | regression | Sen = 0.810 / Spe = 0.820 |
|  |  | HC vs AD (138 / 86) | sentation by local linear embedding FS |  |  | Sen = 0.860 / Spe = 0.930 |
|  |  | MCInc vs MCIc (93 / 97) | by Elastic Net). |  |  | Sen = 0.800 / Spe = 0.560 |
|  |  | MCInc vs AD (93 / 86) |  |  |  | Sen = 0.770 / Spe = 0.730 |
|  |  | MCIc vs AD (97 / 86) |  |  |  | Sen = 0.560 / Spe = 0.610 |
| (Liu, Zhang et al. 2013) | ADNI | HC vs AD (229 / 198) | Voxel-wise GM probability values (reg- | n.a. | SVM (linear) | Sen = 0.853 / Spe = 0.943 |
|  |  | HC vs MCInc (229 / 236) | ularized tree-structured approach for |  |  | Sen = 0.801 / Spe = 0.922 |
|  |  | MCInc vs MCIc (236 / 167) | sparse learning). |  |  | Sen = 0.562 / Spe = 0.809 |
| (Liu, Zhou et al. 2014) | ADNI | HC vs AD (70 / 50) | 126 hippocampal shape features and | CSF biomarkers. | MKL | Sen = 0.933 / Spe = 0.875 |
|  |  |  | GM volumes from 100 ROI’s/ (FS by |  |  |  |
|  |  |  | LASSO). |  |  |  |
| (Liu, Liu et al. 2015) | ADNI | HC vs AD (204 / 180) | Values of volume from T1w and of | n.a. | Deep | Sen = 0.868 / Spe = 0.778 |
|  |  | HC vs MCI (204 / 374) | metabolic rate of glucose consumption | n.a. | learning | Sen = 0.495 / Spe = 0.843 |
|  |  | HC vs MCInc vs MCIc vs AD | from PET in 83 ROI’s (FS by Elastic | n.a. | (SAE) | Acc = 0.463 |
|  |  | (204 / 214 / 160 / 180) | Net). |  |  | Sen = 0.923 / Spe = 0.904 |
|  |  | HC vs AD (77 / 85) |  | PET |  | Sen = 0.600 / Spe = 0.923 |
|  |  | HC vs MCI (77 / 169) |  | PET |  | Acc = 0.538 |
|  |  | HC vs MCInc vs MCIc vs AD |  | PET |  |  |
|  |  | (77 / 102 / 67 / 85) |  |  |  |  |
| (Liu, Cai et al. 2016) | ADNI | HC vs MCI vs AD (77 / 169 / 85) | GM Volume, local gyrification index, | PET. | SVM | ACC = 0.6535 |
|  |  |  | convexity and solidity ratios from T1w, |  | (multi-kernel) |  |
|  |  |  | mean index, fuzzy index, 3 difference- |  |  |  |
|  |  |  | of-Gaussian features from PET in 83 |  |  |  |
|  |  |  | ROI’s. |  |  |  |
| (Liu, Zhang et al. 2016) | ADNI | HC vs AD (128 / 97) | ROI average values from different tem- | n.a. | SVM (ensemble) | Sen = 0.928 / Spe = 0.957 |
|  |  | MCInc vs MCInc (117 / 117) | plates of GM density maps (FS and en- |  |  | Sen = 0.860 / Spe = 0.784 |
|  |  |  | coding by subclass clustering). |  |  |  |
| (Luchtenberg, Simões et al. 2014) | OASIS | HC vs AD (66 / 70) | Dissimilarity matrix of voxel intensity | n.a. | kNN | Sen = 0.800 / Spe = 0.880 |
|  |  |  | histograms. |  |  |  |
| (Martinez-Torteya, Treviño et al. 2015) | ADNI | MCI vs AD (86 / 24) | GM volume in 90 ROI’s, cortical thick- | PET, CSF | LDA | Sen = 0.476 / Spe = 0.941 |
|  |  |  | ness in 139 ROI’s from T1w, metabolic | biomarkers, APOE3, |  |  |
|  |  |  | rate of glucose consumption from PET | plasma, biological |  |  |
|  |  |  | (FS by genetic models and Pearson cor- | samples. |  |  |
|  |  |  | relation coefficients). |  |  |  |
| (Martinez-Murcia, Gorriz et al. 2016) | ADNI | HC vs AD (180 / 180) | LBP features from GM and WM maps | n.a. | SVM (linear) | Sen = 0.899 / Spe = 0.919 |
|  |  |  | (2D representation of the brain and FS |  |  |  |
|  |  |  | by t-test). |  |  |  |
| (McEvoy, Fennema-Notestine et al. 2009) | ADNI | HC vs AD (139 / 84) | Morphometric measures from 58 ROI’s. | n.a. | LDA | Sen = 0.830 / Spe = 0.930 |
| (Moradi, Pepe et al. 2015) | ADNI | MCInc vs MCIc (100 / 164) | Voxel-wise GM density values (FS by | Age, RAVLT, | Random | Sen = 0.870 / Spe = 0.740 |
|  |  |  | regularized logistic regression). | ADAS-Cog, MMSE, | forest + |  |
|  |  |  |  | CDR-SB, FAQ. | SVM (RBF) |  |
| (Morgado and Silveira 2015) | ADNI | HC vs AD (75 / 59) | Voxel-wise GM density values (FS | n.a. | SVM | Sen = 0.869 / Spe = 0.872 |
|  |  | HC vs MCI (75 / 135) | by Minimal Neighborhood Redundancy |  |  | Sen = 0.688 / Spe = 0.670 |
|  |  |  | Maximal Relevance). |  |  |  |
| (Nho, Shen et al. 2010) | ADNI | HC vs AD (226 / 182) | GM density values from 86 ROI’s, cor- | APOE3, | SVM (RBF) | Sen = 0.850 / Spe = 0.948 |
|  |  | HC vs MCI (226 / 355) | tical thickness values from 56 ROI’s (FS | family history. |  | Sen = 0.694 / Spe = 0.698 |
|  |  |  | by SVM-RFE). |  |  |  |
| (Plocharski and Østergaard 2016) | ADNI | HC vs AD (96 / 109) | Depth, length, curvature and surface | n.a. | SVM (linear) | Sen = 0.900 / Spe = 0.867 |
|  |  |  | area of 24 sulci (FS by forward selec- |  |  |  |
|  |  |  | tion). |  |  |  |
| (Rao, Lee et al. 2011) | Local | HC vs AD (60 / 69) | Voxel-wise GM density values (FS by | n.a. | Logistic | Sen = 0.904 / Spe = 0.803 |
|  |  |  | spatially regularized formulation). |  | regression |  |
| (Rueda, Gonzalez et al. 2014) | OASIS | HC vs MCI + AD (98 / 100) | Voxel intensities (graph-based saliency | n.a. | MKL | Sen = 0.670 / Spe = 0.735 |
|  |  |  | map representation). |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- |
| Reference | Dataset | Classification | Image features | Additional imaging | Classifiers | Results |
|  |  | tasks (n) | (FS and representation) | sequences and features |  |  |
| (Savio and GrañA 2013) | OASIS | HC vs AD (316 / 100) | Voxel intensities (represented as the | n.a. | SVM (RBF) | Sen = 0.856 / Spe = 0.863 |
|  |  |  | trace of the Jacobian matrix from |  |  |  |
|  |  |  | tensor-based morphometry analysis. |  |  |  |
|  |  |  | FS by t-test). |  |  |  |
| (Schmitter, Roche et al. 2015) | ADNI | HC vs AD (276 / 221) | Volumes, obtained from FreeSurfer or | n.a. | SVM | Sen = 0.860 / Spe = 0.910 |
|  |  | HC vs MCI (276 / 401) | MorphoBox of: total GM, left and right |  |  | Sen = 0.690 / Spe = 0.830 |
|  |  | MCI vs AD (401 / 221) | temporal GM, left and right hippocam- |  |  | Sen = 0.690 / Spe = 0.670 |
|  |  | MCInc vs MCIc (103 / 137) | pus, total CSF, and lateral, 3 and 4 ven- |  |  | Sen = 0.750 / Spe = 0.660 |
|  |  |  | tricles. |  |  |  |
| (Schouten, Koini et al. 2016) | Local | HC vs AD (173 / 77) | GM density values in 110 ROI’s, WM | DTI, fMRI. | Regularized | Sen = 0.826 / Spe = 0.927 |
|  |  | HC vs AD mild (173 / 39) | density values in 20 ROI’s from T1w. |  | logistic | Sen = 0.721 / Spe = 0.935 |
|  |  | HC vs AD moderate | FA and MD values in 20 ROI’s. 2415 |  | regression | Sen = 0.813 / Spe = 0.956 |
|  |  | (173 / 38) | values of correlation from functional |  |  |  |
|  |  |  | connectivity analysis from fMRI (FS by |  |  |  |
|  |  |  | Elastic Net). |  |  |  |
| (Shi, Suk et al. 2014) | ADNI | HC vs AD (52 / 51) | GM volumes and PET intensity values | PET | SVM (linear) | Sen = 0.942 / Spe = 0.969 |
|  |  | HC vs MCI (52 / 99) | in 93 ROI’s (FS by Lasso). |  | SRC | Sen = 0.817 / Spe = 0.762 |
| (Singh, Fletcher et al. 2014) | ADNI | MCInc vs MCIc (73 / 54) | Anatomical shape variations with re- | PET, APOE3, | QDA | Sen = 0.942 / Spe = 0.969 |
|  |  |  | spect to atlas (FS by partial least | CSF biomarkers. |  | Sen = 0.817 / Spe = 0.762 |
|  |  |  | square model). |  |  |  |
| (Spulber, Simmons et al. 2013) | AddNeuroMed, | HC vs AD (52 / 51) | Volumes of 23 ROI’s and cortical thick- | PET | OPLS | Sen = 0.861 / Spe = 0.904 |
|  | ADNI | HC vs MCI (52 / 99) | ness values of 34 ROI’s. |  |  | Sen = 0.696 / Spe = 0.668 |
| (Suk, Lee et al. 2015) | ADNI | HC vs AD (52 / 51) | GM volumes and PET intensity val- | PET, | SVM | Sen = 0.920 / Spe = 0.980 |
|  |  | HC vs MCI (52 / 99) | ues in 93 ROI’s (FS by deep weighted | CSF biomarkers. |  | Sen = 0.939 / Spe = 0.908 |
|  |  | HC vs MCI vs AD(229 / | subclass-based sparse multi-task learn- |  |  | Acc = 0.577 |
|  |  | 403 / 198) | ing approach). |  |  |  |
|  |  | HC vs MCInc vs MCIc vs AD |  |  |  | Acc = 0.478 |
|  |  | (229 / 236 / 167 / 198) |  |  |  |  |
| (Tong, Wolz et al. 2014) | ADNI | HC vs AD (231 / 198) | Voxel intensity from a variable num- | n.a. | SVM | Sen = 0.849 / Spe = 0.926 |
|  |  | HC vs MCIc (231 / 167) | ber K of patches (MIL approach, FS by |  |  | Sen = 0.689 / Spe = 0.931 |
|  |  | MCInc vs MCIc (238 / 167) | Elastic Net). |  |  | Sen = 0.665 / Spe = 0.731 |
| (Varol, Gaonkar et al. 2012) | ADNI | HC vs AD (148 / 116) | Voxel-wise density values from GM, | n.a. | SVM (ensemble) | Sen = 0.862 / Spe = 0.897 |
|  |  |  | WM and ventricles maps (FS by t-test). |  |  |  |
| (Vemuri, Gunter et al. 2008) | ADNI | HC vs AD (50 / 50) | Voxel-wise density values from GM, | Demographics, | SVM (linear) | Sen = 0.860 / Spe = 0.920 |
|  |  |  | WM and CSF maps (FS by feature | APOE3. |  |  |
|  |  |  | ranking). |  |  |  |
| (Wachinger and Reuter 2016) | ADNI | HC vs MCI vs AD (129 / 122 / 103) | Cortical thickness values in 70 ROI’s, | n.a. | Multinomial | Acc = 0.590 |
|  |  |  | volumes of 39 ROI’s and 58 shape fea- |  | regression |  |
|  |  |  | tures. (FS by Elastic Net). |  |  |  |
| (Wang, Jia et al. 2012) | ADNI | HC vs AD (229 / 199) | GM, WM CSF values in 54 ROI’s ob- | n.a. | SVM (linear) | Sen = 0.861 / Spe = 0.918 |
|  |  | MCI vs AD (404 / 199) | tained from MABMIS pipeline (FS by |  |  | Sen = 0.403 / Spe = 0.870 |
|  |  | HC vs MCI (229 / 404) | t-test). |  |  | Sen = 0.794 / Spe = 0.881 |
|  |  | MCInc vs MCIc (236 / 168) |  |  |  | Sen = 0.667 / Spe = 0.723 |
| (Wang, Du et al. 2015) | ADNI | HC vs MCI (52 / 99) | GM volumes and PET intensity values | PET, | SVM (linear) | Sen = 0.827 / Spe = 0.473 |
|  |  |  | in 93 ROI’s (FS by PCA). | CSF biomarkers. |  |  |
| (Wee, Yap et al. 2012) | ADNI | HC vs AD (200 / 198) | Cortical thickness, GM and WM vol- | n.a. | SVM (RBF, | Sen = 0.904 / Spe = 0.943 |
|  |  | HC vs MCI (200 / 200) | umes in 68 ROI’s. Correlative features |  | multi-kernel) | Sen = 0.836 / Spe = 0.840 |
|  |  | MCI vs AD (200 / 198) | between pairs of ROI’s (FS by t-test, |  |  | Sen = 0.780 / Spe = 0.805 |
|  |  | MCInc vs MCIc (111 / 89) | mRMR and SVM-RFE). |  |  | Sen = 0.635 / Spe = 0.844 |
| (Wei, Li et al. 2016) | ADNI | MCInc vs MCIc (83 / 76) | Cortical thickness, volume, and cortical | n.a. | SVM (RBF) | Sen = 0.684 / Spe = 0.759 |
|  |  |  | surface area in 68 ROI’s. 136 nodal fea- |  |  |  |
|  |  |  | tures from the thickness network(FS by |  |  |  |
|  |  |  | regularized sparse linear regression). |  |  |  |
| (Westman, Simmons et al. 2011) | AddNeuroMed, | HC vs AD (335 / 295) | Cortical thicknessin in 57 selected | n.a. | OPLS | Sen = 0.834 / Spe = 0.878 |
|  | ADNI | MCInc vs MCIc (353 / 84) | ROI’s and volumes of 23 ROI’s. |  |  | Sen = 0.714 / Spe = 0.601 |
| (Wolz, Julkunen et al. 2011) | AddNeuroMed, | HC vs AD (231 / 198) | Hippocampal volume, cortical thickness | n.a. | LDA | Sen = 0.930 / Spe = 0.850 |
|  | ADNI | HC vs MCIc (231 / 167) | from different ROI’s, 84 tensor-based |  |  | Sen = 0.860 / Spe = 0.820 |
|  |  | MCInc vs MCIc (238 / 167) | morphometry and 20 manifold learning |  |  | Sen = 0.670 / Spe = 0.690 |
|  |  |  | features (FS by t-test). |  |  |  |
| (Xie, Cui et al. 2015) | Local | HC vs MCI (64 / 64) | Voxel-wise value of GM from T1w and | DTI. | SVM (linear, | Sen = 0.786 / Spe = 0.888 |
|  |  |  | FA and MD from DTI (FS by t-test). |  | ensemble) |  |
| (Xu, Wu et al. 2015) | ADNI | HC vs AD (117 / 113) | GM volumes from T1w and uptake val- | PET (FDG and | SRC | Sen = 0.956 / Spe = 0.940 |
|  |  | HC vs MCI (117 / 110) | ues from PET in 90 ROI’s (FS by t- | Florbetapir). |  | Sen = 0.664 / Spe = 0.821 |
|  |  | MCInc vs MCIc (83 / 27) | test). |  |  | Sen = 0.741 / Spe = 0.815 |
| (Yang, Li et al. 2014) | ADNI | HC vs AD (150 / 70) | Voxel-wise values from GM map (ICA | MMSE, | SVM | Sen = 0.992 / Spe = 0.962 |
|  |  | HC vs MCI (150 / 98) | decomposition and FS by t-test). | GDTOTAL, |  | Sen = 0.860 / Spe = 0.896 |
|  |  |  |  | HMSCORE. |  |  |
| (Ye, Pohl et al. 2011) | ADNI | MCInc vs MCIc (169 / 68) | GM RAVENS map (graph representa- | n.a. | SVM (linear | Sen = 0.941 / Spe = 0.408 |
|  |  |  | tion and FS by ISOMAP). |  | Laplacian, |  |
|  |  |  |  |  | semi-supervised) |  |
| (Ye, Zu et al. 2015) | ADNI | HC vs AD (52 / 51) | GM volumes and PET intensity val- | PET. | SVM (linear, | Sen = 0.947 / Spe = 0.971 |
|  |  | HC vs MCI (52 / 99) | ues in 93 ROI’s (FS by discriminative |  | multi-kernel) | Sen = 0.877 / Spe = 0.715 |
|  |  |  | multi-task approach). |  |  |  |
| (Young, Modat et al. 2013) | ADNI | MCInc vs MCIc (96 / 47) | GM volumes and PET intensity values | PET, APOE3. | Gaussian | Sen = 0.787 / Spe = 0.656 |
|  |  |  | in 920 ROI’s. |  | process |  |
| (Zhang, Wang et al. 2011) | ADNI | HC vs AD (52 / 51) | GM volumes and PET intensity values | PET, | SMV (linear, | Sen = 0.930 / Spe = 0.933 |
|  |  | HC vs MCI (52 / 99) | in 93 ROI’s. | CSF biomarkers. | multi-kernel) | Sen = 0.818 / Spe = 0.660 |
| (Zhang, Wang et al. 2015) | OASIS | HC vs MCI vs AD | 3D-DWT decomposition features, ICV, | Demographics, | SMV (RBF) | Acc = 0.815 |
|  |  | (97 / 57 / 24) | atlas scaling factor, normalized brain | Education, |  |  |
|  |  |  | volume (FS by PCA.) | SES, MMSE. |  |  |
| (Zhang and Wang 2015) | OASIS | HC vs AD (98 / 28) | Voxel-wise displacement field values | PET, APOE3. | SVM (twin) | Sen = 0.906 / Spe = 0.934 |
|  |  |  | (direction and magnitude) of key T1w |  |  |  |
|  |  |  | slices. (FS by PCA.) |  |  |  |
| (Zhang, Stonnington et al. 2016) | ADNI | HC vs AD (228 / 194) | Hippocampal surface tensor-based mor- | n.a. | Adaboost | Sen = 0.830 / Spe = 0.780 |
|  |  | MCInc vs MCIc (246 / 142) | phometry features and radial distance |  |  | Sen = 0.820 / Spe = 0.760 |
|  |  |  | (FS by sparse coding) |  |  |  |
| (Zheng, Yao et al. 2015) | ADNI | HC vs AD (189 / 163) | Cortical thickness in 78 ROI’s (cor- | APOE3. | SVM (RBF) | Sen = 0.899 / Spe = 0.943 |
|  |  | HC vs MCI (189 / 198) | relation matrix representation, FS by |  |  | Sen = 0.878 / Spe = 0.858 |
|  |  | MCI vs AD (198 / 163) | mRMR and SVM-RFE). |  |  | Sen = 0.806 / Spe = 0.899 |
|  |  | MCInc vs MCIc (94 / 104) |  |  |  | Sen = 0.789 / Spe = 0.799 |
| (Zheng, Shi et al. 2016) | ADNI | HC vs AD (52 / 51) | GM volumes and PET intensity values | PET. | SVM (linear) | Sen = 0.973 / Spe = 0.983 |
|  |  |  | in 93 ROI’s (high-level representation |  |  |  |
|  |  |  | from multi-modality stacked deep poly- |  |  |  |
|  |  |  | nomial network) |  |  |  |
| (Zhou, Goryawala et al. 2014) | ADNI | HC vs AD (127 / 59) | 41 regional and 10 morphometric vol- | MMSE. | SVM (RBF) | Sen = 0.840 / Spe = 0.961 |
|  |  | HC vs MCIc (127 / 67) | umes (FS by t-test). |  |  | Sen = 0.611 / Spe = 0.834 |
|  |  | HC vs MCInc (127 / 56) |  |  |  | Sen = 0.552 / Spe = 0.823 |
| (Zhu, Suk et al. 2014) | ADNI | HC vs AD (52 / 51) | GM volumes and PET intensity values | n.a. | SVM | Sen = 0.886 / Spe = 0.978 |
|  |  | HC vs MCI (52 / 99) | in 93 ROI’s (FS by regularized least |  |  | Sen = 0.948 / Spe = 0.569 |
|  |  |  | square regression). |  |  |  |
| (Zhu and Shi 2014) | ADNI | HC vs AD (52 / 51) | GM volumes in 93 ROI’s (co-training | n.a. | SVM (linear) | Sen = 0.869 / Spe = 0.904 |
|  |  |  | semi-supervised learning approach). |  |  |  |
| (Zhu, Shi et al. 2014) | ADNI | HC vs AD (52 / 51) | GM volumes and PET intensity values | n.a. | SVM (linear) | Sen = 0.952 / Spe = 0.907 |
|  |  |  | in 93 ROI’s (FS by Hessian regulariza- |  |  |  |
|  |  |  | tion semi-supervised approach). |  |  |  |
| (Zhu, Suk et al. 2015) | ADNI | HC vs MCI vs AD | GM volumes and PET intensity values | PET. | SMV | Acc = 0.729 |
|  |  | (52 / 99 / 51) | in 93 ROI’s (CCA representation and |  |  |  |
|  |  | HC vs MCInc vs MCIc vs AD | FS by multi-task learning). |  |  | Acc = 0.619 |
|  |  | (52 / 56 / 43 / 51) |  |  |  |  |

Table S4. Machine learning methods for classification of other types of dementia.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference | Dataset | | Validation | | Tasks | | Imaging | | Imaging features | | Classifiers | | Acc | |
|  | (population) | | set size | |  | | sequences | | (FS and representation) | |  | |  | |
| (Chen, Tong et al. 2015) | Local | | 350 / 240 | | HC vs SVD | | CT | | Voxel intensities in ROI’s from WML-based | | MIL | | 0.75 | |
|  | (Stroke) | |  | |  | |  | | atlas. | |  | |  | |
| (Koikkalainen, Rhodius-Meester et al. 2016) | Local | | 118 / 223 / 92 | | HC vs AD vs FTD | | T1w, FLAIR. | | Volumes of 142 ROI’s, values of TBM and | | Multimodal | | 0.706 | |
|  | (Dementia) | | / 47 / 24 | | vs DLB vs SVD | |  | | VBM in 140 ROI’s, 20 manifold learning fea- | | statistical | |  | |
|  |  | |  | |  | |  | | tures, 8 ROI-based gradings and 1 vascular | | approach. | |  | |
|  |  | |  | |  | |  | | burden measure. | |  | |  | |
| (Oppedal, Eftestøl et al. 2015) | Local | | 36 / 57 / 16 | | HC vs AD vs LBD | | T1w, FLAIR. | | Voxel-wise 2D-LBP and contrast features from | | Random | | 0.87 | |
|  | (Dementia) | |  | |  | |  | | WM amd WML regions in T1w and FLAIR | | forest. | |  | |
|  |  | |  | |  | |  | | (FS by best first approach). | |  | |  | |
| (Vemuri, Simon et al. 2011) | Local | | 48 / 20 / 47 | | AD vs FTD vs LBD | | T1w. | | GM volumes in 91 ROI’s (FS by LDA). | | k-means | | 0.867 | |
|  | (Dementia) | |  | |  | |  | |  | |  | |  | |
| (Wang, Redmond et al. 2016) | Local | | 54 / 55 | | AD vs FTD | | T1w. | | 17 neurophysiological features and GM vol- | | Naive | | 0.6147 | |
|  | (Dementia) | | 57 / 54 / 55 | | HC vs AD vs FTD | |  | | umes of 8 ROI’ss (amygdala, hippocampus, | | Bayes | | 0.6747 | |
|  |  | |  | |  | |  | | medial temporal lobe, temporal pole, dorsolat- | |  | |  | |
|  |  | |  | |  | |  | | eral prefrontal cortex, ventromedial prefrontal | |  | |  | |
|  |  | |  | |  | |  | | cortex, striatum and insula (FS by best first | |  | |  | |
|  | |  | |  | |  | |  | | approach). | |  | |  | |