

ANTsX neuroimaging-derived structural phenotypes of UK Biobank

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1 Age

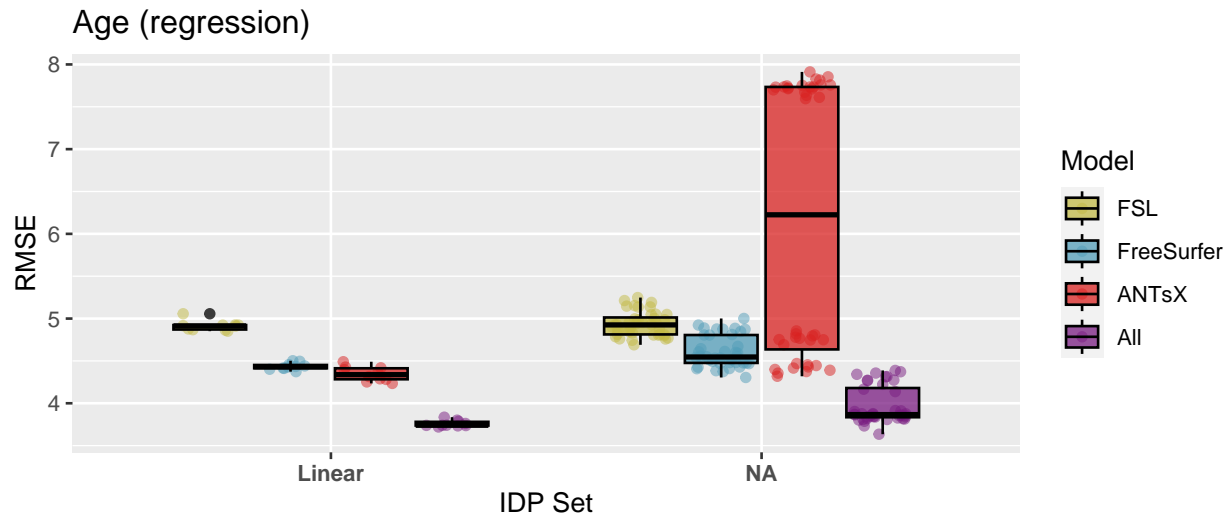


Figure 1: Age

1.1 Feature ranking: Linear

- FSL
 - range: [NA , NA]
 - std: NA
 - skewness: NA
- FreeSurfer
 - range: [0.1526888 , 15.03373]
 - std: 2.686921
 - skewness: 2.324572
- ANTsX
 - range: [0.1354494 , 17.57277]
 - std: 2.308719
 - skewness: 2.238218

1.1.1 Package-based ranking (top 10 features)

- FSL: rank = 363 , imp = 77.09145
- FreeSurfer: rank = 80 , imp = 121.5785
- ANTsX: rank = 166 , imp = 108.6568

Table 1: Age

Package	Pipeline	Feature
ANTsX	Atropos	Cerebellum
FreeSurfer	ASEG	Volume of WM-hypointensities (whole brain)
ANTsX	Cereb	L_III volume
FreeSurfer	ASEG	Volume of CerebralWhiteMatter (left hemisphere)
FreeSurfer	ASEG	Volume of CerebralWhiteMatter (right hemisphere)
FreeSurfer	ASEG	Volume of CC-Central (whole brain)
FreeSurfer	ASEG	Volume of SupraTentorial (whole brain)
FSL	Other	Continuous Volume of grey matter
FreeSurfer	ASEG	Volume of TotalGray (whole brain)
FreeSurfer	ASEG	Volume of Cortex (left hemisphere)
FreeSurfer	ASEG	Volume of VentricleChoroid (whole brain)
FreeSurfer	ASEG	Volume of Cortex (right hemisphere)
ANTsX	Cereb	CerebellarCSF volume
FreeSurfer	ASEG	Volume of VentralDC (right hemisphere)
ANTsX	Region	Right cerebellum exterior
FreeSurfer	ASEG	Volume of VentralDC (left hemisphere)
ANTsX	Cereb	CerebellarWhiteMatter volume
FreeSurfer	ASEG	Volume of SubCortGray (whole brain)
ANTsX	Region	Cerebellar vermal lobules VI VII
ANTsX	Region	Left caudate
FreeSurfer	ASEG	Volume of Amygdala (right hemisphere)
ANTsX	Region	Right lateral ventricle
ANTsX	Atropos	BrainStem
FreeSurfer	ASEG	Volume of Cerebellum-Cortex (left hemisphere)
FreeSurfer	ASEG	Volume of Caudate (left hemisphere)

1.1.2 Package-based ranking (top 25 features)

- FSL: rank = 1615 , imp = 155.1536
- FreeSurfer: rank = 561 , imp = 241.8775
- ANTsX: rank = 919 , imp = 205.7617

1.1.3 Package-based ranking (top 50 features)

- FSL: rank = 5368 , imp = 248.9677
- FreeSurfer: rank = 3346 , imp = 355.6919
- ANTsX: rank = 3177 , imp = 331.0176

2 FluidIntelligenceScore

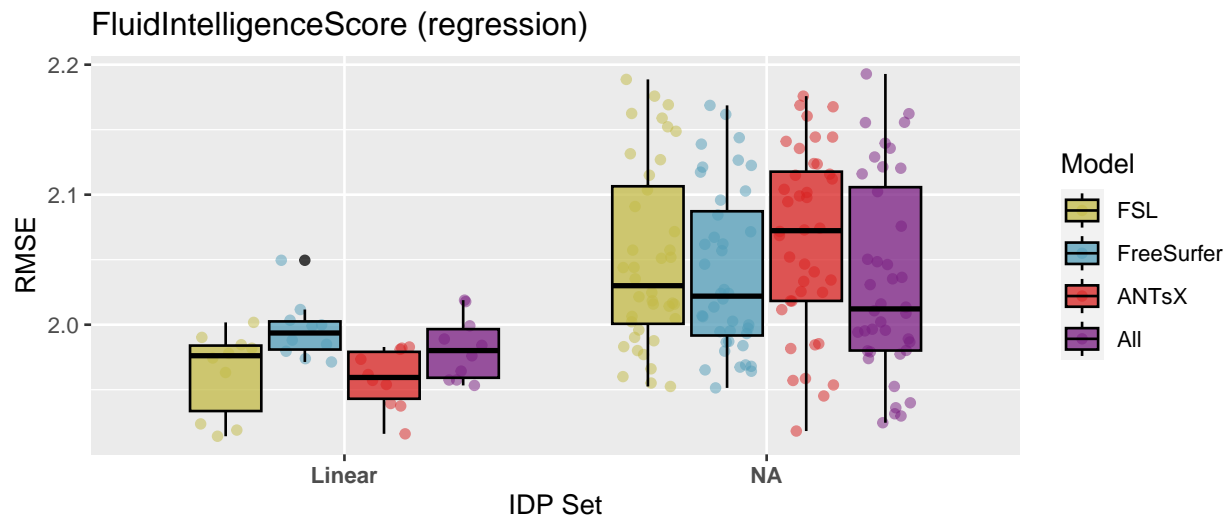


Figure 2: FluidIntelligenceScore

2.1 Feature ranking: Linear

- FSL
 - range: [0.1864763 , 4.409947]
 - std: 0.6514862
 - skewness: 1.818237
- FreeSurfer
 - range: [0.1644809 , 4.097554]
 - std: 0.5718555
 - skewness: 1.554328
- ANTsX
 - range: [0.1397266 , 3.695379]
 - std: 0.5723668
 - skewness: 1.259365

2.1.1 Package-based ranking (top 10 features)

- FSL: rank = 170 , imp = 26.70319
- FreeSurfer: rank = 151 , imp = 24.63818
- ANTsX: rank = 195 , imp = 24.59515

Table 2: FluidIntelligenceScore

Package	Pipeline	Feature
FSL	FAST	Volume of grey matter in Amygdala (right)
FreeSurfer	ASEG	Volume of CC-Mid-Anterior (whole brain)
ANTsX	Thickness	Left paracentral
FSL	FAST	Volume of grey matter in Intracalcarine Cortex (right)
FSL	Other	Continuous Volume of peripheral cortical grey matter
ANTsX	Thickness	Left superior frontal
FSL	FAST	Volume of grey matter in Amygdala (left)
ANTsX	Thickness	Left inferior temporal
FSL	FAST	Volume of grey matter in Middle Temporal Gyrus - posterior division (left)
ANTsX	Region	Left hippocampus
FreeSurfer	Thickness	Mean thickness of superiorparietal (left hemisphere)
FreeSurfer	Thickness	Mean thickness of isthmuscingulate (right hemisphere)
FreeSurfer	ASEG	Volume of Inf-Lat-Vent (left hemisphere)
FSL	FAST	Volume of grey matter in Superior Temporal Gyrus - posterior division (right)
FreeSurfer	ASEG	Volume of Cortex (left hemisphere)
FSL	FAST	Volume of grey matter in X Cerebellum (left)
FreeSurfer	Thickness	Mean thickness of fusiform (right hemisphere)
FreeSurfer	ASEG	Volume of Cortex (right hemisphere)
ANTsX	Cortical	Left rostral middle frontal volume
FreeSurfer	HippAmyg	Volume of subiculum-body (right hemisphere)
FreeSurfer	HippAmyg	Volume of HATA (right hemisphere)
FreeSurfer	HippAmyg	Volume of CA4-body (right hemisphere)
FreeSurfer	HippAmyg	Volume of Hippocampal-tail (right hemisphere)
FreeSurfer	HippAmyg	Volume of parasubiculum (right hemisphere)
ANTsX	Thickness	Left caudal middle frontal

2.1.2 Package-based ranking (top 25 features)

- FSL: rank = 1437 , imp = 52.0111
- FreeSurfer: rank = 764 , imp = 54.65516
- ANTsX: rank = 957 , imp = 53.44664

2.1.3 Package-based ranking (top 50 features)

- FSL: rank = 5444 , imp = 84.00483
- FreeSurfer: rank = 3010 , imp = 96.27253
- ANTsX: rank = 3534 , imp = 92.52846

3 NeuroticismScore

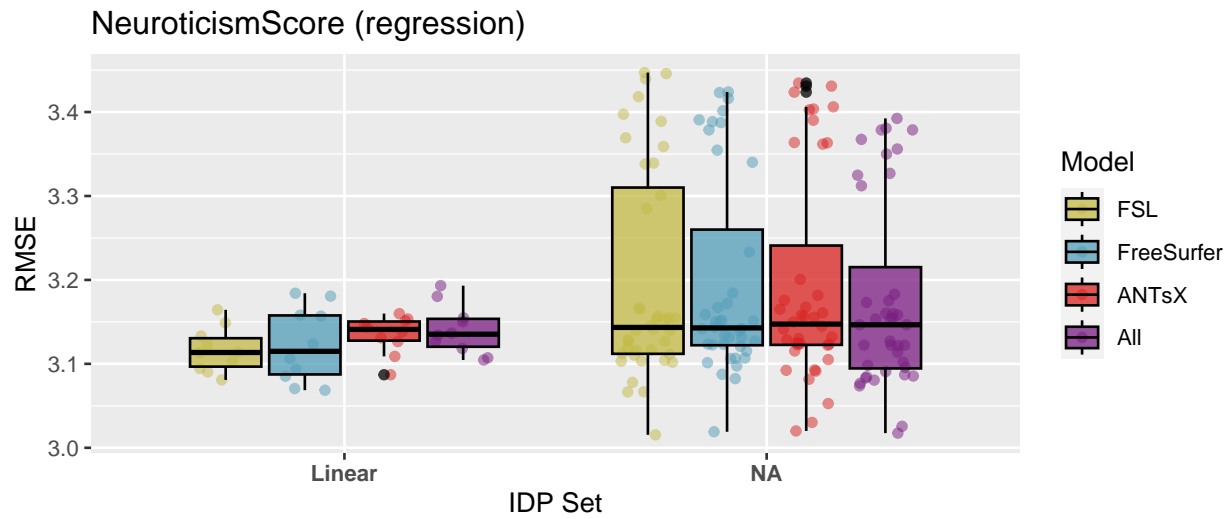


Figure 3: NeuroticismScore

3.1 Feature ranking: Linear

- FSL
 - range: [0.1497857 , 11.49945]
 - std: 1.249287
 - skewness: 5.875585
- FreeSurfer
 - range: [0.1914575 , 3.135206]
 - std: 0.4852226
 - skewness: 1.354637
- ANTsX
 - range: [0.1026427 , 3.387002]
 - std: 0.5902549
 - skewness: 1.504382

3.1.1 Package-based ranking (top 10 features)

- FSL: rank = 116 , imp = 43.61838
- FreeSurfer: rank = 213 , imp = 23.50922
- ANTsX: rank = 143 , imp = 27.62823

Table 3: NeuroticismScore

Package	Pipeline	Feature
FSL	FAST	Volume of grey matter in Amygdala (left)
FSL	FAST	Volume of grey matter in Amygdala (right)
FSL	FAST	Volume of grey matter in Superior Frontal Gyrus (left)
ANTsX	Thickness	Right pericalcarine
ANTsX	Cortical	Right middle temporal volume
FSL	FAST	Volume of grey matter in VI Cerebellum (vermis)
FreeSurfer	ASEG	Volume of CC-Posterior (whole brain)
FSL	FAST	Volume of grey matter in Frontal Operculum Cortex (left)
FSL	FAST	Volume of grey matter in Temporal Pole (left)
ANTsX	Thickness	Right postcentral
ANTsX	Thickness	Left supramarginal
ANTsX	Cortical	Right isthmus cingulate volume
FSL	FAST	Volume of grey matter in Middle Frontal Gyrus (left)
ANTsX	Cereb	L_ VIIIA thickness
ANTsX	Region	Right middle temporal
FreeSurfer	HippAmyg	Volume of Whole-hippocampus (right hemisphere)
FreeSurfer	Volume	Volume of medialorbitofrontal (left hemisphere)
FreeSurfer	Thickness	Mean thickness of superiorparietal (right hemisphere)
FreeSurfer	Volume	Volume of parstriangularis (right hemisphere)
FreeSurfer	Thickness	Mean thickness of parsopercularis (left hemisphere)
FSL	FAST	Volume of grey matter in Caudate (right)
ANTsX	Region	Left posterior cingulate
ANTsX	DeepFLASH	Left aLEC
FSL	FAST	Volume of grey matter in Frontal Pole (right)
FreeSurfer	Volume	Volume of fusiform (left hemisphere)

3.1.2 Package-based ranking (top 25 features)

- FSL: rank = 973 , imp = 69.36826
- FreeSurfer: rank = 1130 , imp = 48.81682
- ANTsX: rank = 842 , imp = 54.85405

3.1.3 Package-based ranking (top 50 features)

- FSL: rank = 4902 , imp = 99.63279
- FreeSurfer: rank = 3959 , imp = 83.64052
- ANTsX: rank = 3164 , imp = 91.80446

4 NumericMemory

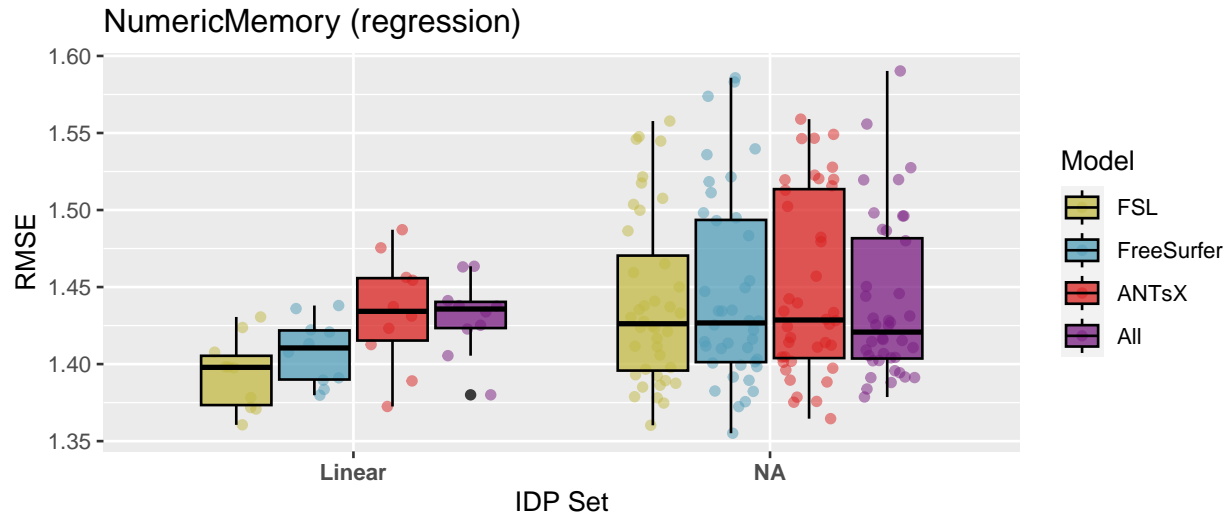


Figure 4: NumericMemory

4.1 Feature ranking: Linear

- FSL
 - range: [0.09549313 , 4.647745]
 - std: 0.7300451
 - skewness: 1.850753
- FreeSurfer
 - range: [0.1542513 , 2.957326]
 - std: 0.5181698
 - skewness: 1.581697
- ANTsX
 - range: [0.1409571 , 3.140423]
 - std: 0.5994258
 - skewness: 1.195387

4.1.1 Package-based ranking (top 10 features)

- FSL: rank = 109 , imp = 29.89693
- FreeSurfer: rank = 288 , imp = 22.55545
- ANTsX: rank = 144 , imp = 26.20399

Table 4: NumericMemory

Package	Pipeline	Feature
FSL	FAST	Volume of grey matter in Amygdala (left)
FSL	Other	Continuous Volume of peripheral cortical grey matter
ANTsX	Thickness	Right lateral orbitofrontal
FSL	FAST	Volume of grey matter in Hippocampus (right)
FreeSurfer	ASEG	Volume of CSF (whole brain)
FSL	FAST	Volume of grey matter in Precentral Gyrus (right)
FSL	FAST	Volume of grey matter in Middle Temporal Gyrus - temporooccipital part (right)
ANTsX	Cortical	Right isthmus cingulate volume
ANTsX	Region	Right isthmus cingulate
FreeSurfer	HippAmyg	Volume of Whole-hippocampus (left hemisphere)
FreeSurfer	Thickness	Mean thickness of isthmuscingulate (left hemisphere)
ANTsX	DeepFLASH	Left subiculum
FSL	Other	Continuous Volume of grey matter
ANTsX	Cereb	L_I_II thickness
FSL	FAST	Volume of grey matter in Crus I Cerebellum (vermis)
ANTsX	Cortical	Left parahippocampal volume
FSL	Other	Continuous Volume of peripheral cortical grey matter (normalised for head size)
FSL	FAST	Volume of grey matter in Intracalcarine Cortex (left)
ANTsX	Thickness	Right superior parietal
ANTsX	Cortical	Left caudal anterior cingulate volume
ANTsX	Cortical	Right caudal anterior cingulate volume
ANTsX	DeepFLASH	Right MTL
ANTsX	Thickness	Right superior temporal
FreeSurfer	Thickness	Mean thickness of rostralanteriorcingulate (left hemisphere)
ANTsX	Region	Right lateral orbitofrontal

4.1.2 Package-based ranking (top 25 features)

- FSL: rank = 955 , imp = 57.76288
- FreeSurfer: rank = 1238 , imp = 49.30908
- ANTsX: rank = 755 , imp = 57.06385

4.1.3 Package-based ranking (top 50 features)

- FSL: rank = 4439 , imp = 90.58995
- FreeSurfer: rank = 4467 , imp = 83.32317
- ANTsX: rank = 2904 , imp = 97.12109

5 BMI

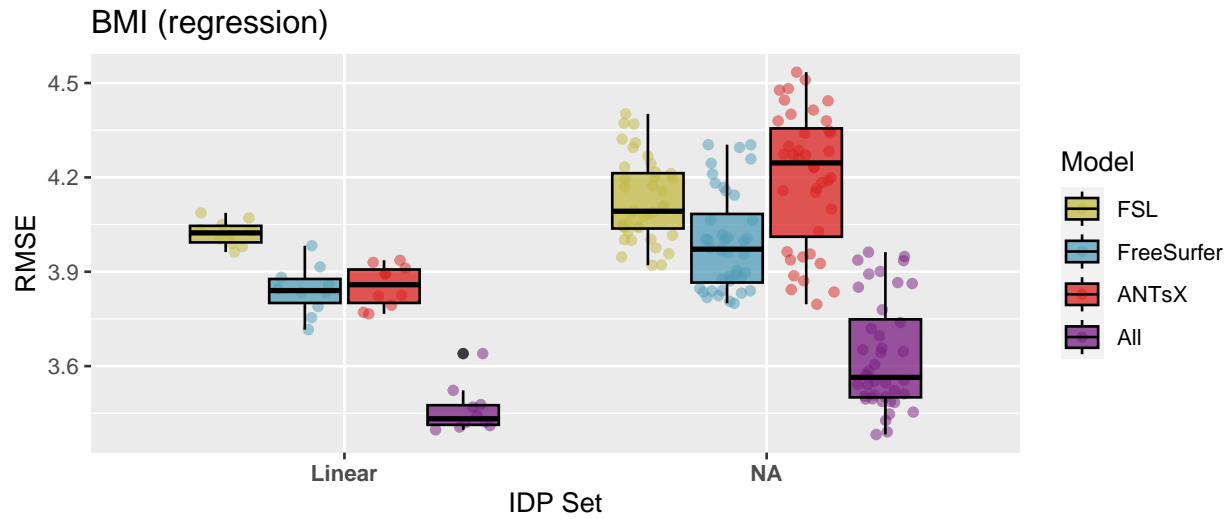


Figure 5: BMI

5.1 Feature ranking: Linear

- FSL
 - range: [0.1562628 , 12.46823]
 - std: 2.429514
 - skewness: 1.476122
- FreeSurfer
 - range: [0.159632 , 12.3667]
 - std: 2.219477
 - skewness: 1.776937
- ANTsX
 - range: [0.1637263 , 12.64787]
 - std: 1.924288
 - skewness: 2.005405

5.1.1 Package-based ranking (top 10 features)

- FSL: rank = 131 , imp = 94.45128
- FreeSurfer: rank = 164 , imp = 91.74847
- ANTsX: rank = 210 , imp = 88.12971

Table 5: BMI

Package	Pipeline	Feature
ANTsX	Thickness	Left paracentral
FSL	FAST	Volume of grey matter in Amygdala (left)
FreeSurfer	ASEG	Volume of Cerebellum-White-Matter (right hemisphere)
ANTsX	Cereb	CerebellarGrayMatter volume
FreeSurfer	ASEG	Volume of Cerebellum-White-Matter (left hemisphere)
ANTsX	Thickness	Left lingual
FreeSurfer	ASEG	Volume of EstimatedTotalIntraCranial (whole brain)
ANTsX	Atropos	BrainStem
FSL	Other	Continuous Volume of peripheral cortical grey matter (normalised for head size)
FSL	FAST	Volume of grey matter in Occipital Fusiform Gyrus (right)
FSL	FAST	Volume of grey matter in Lateral Occipital Cortex - superior division (right)
FSL	FAST	Volume of grey matter in Amygdala (right)
FSL	FAST	Volume of grey matter in Lingual Gyrus (right)
FreeSurfer	ASEG	Volume of VentralDC (right hemisphere)
FreeSurfer	ASEG	Volume of SupraTentorialNotVent (whole brain)
FSL	FAST	Volume of grey matter in Caudate (left)
FreeSurfer	Thickness	Mean thickness of superiorfrontal (left hemisphere)
FSL	FAST	Volume of grey matter in Cuneal Cortex (left)
FSL	FAST	Volume of grey matter in VIIIa Cerebellum (left)
ANTsX	Region	Left thalamus proper
FSL	FAST	Volume of grey matter in Pallidum (right)
FSL	FAST	Volume of grey matter in IX Cerebellum (right)
FreeSurfer	Volume	Volume of transversetemporal (right hemisphere)
FSL	FIRST	Volume of caudate (left)
FreeSurfer	Volume	Volume of isthmuscingulate (right hemisphere)

5.1.2 Package-based ranking (top 25 features)

- FSL: rank = 923 , imp = 187.4333
- FreeSurfer: rank = 796 , imp = 188.4521
- ANTsX: rank = 1220 , imp = 172.7291

5.1.3 Package-based ranking (top 50 features)

- FSL: rank = 4453 , imp = 284.1735
- FreeSurfer: rank = 3170 , imp = 307.6056
- ANTsX: rank = 4106 , imp = 277.511

6 TownsendDeprivationIndex

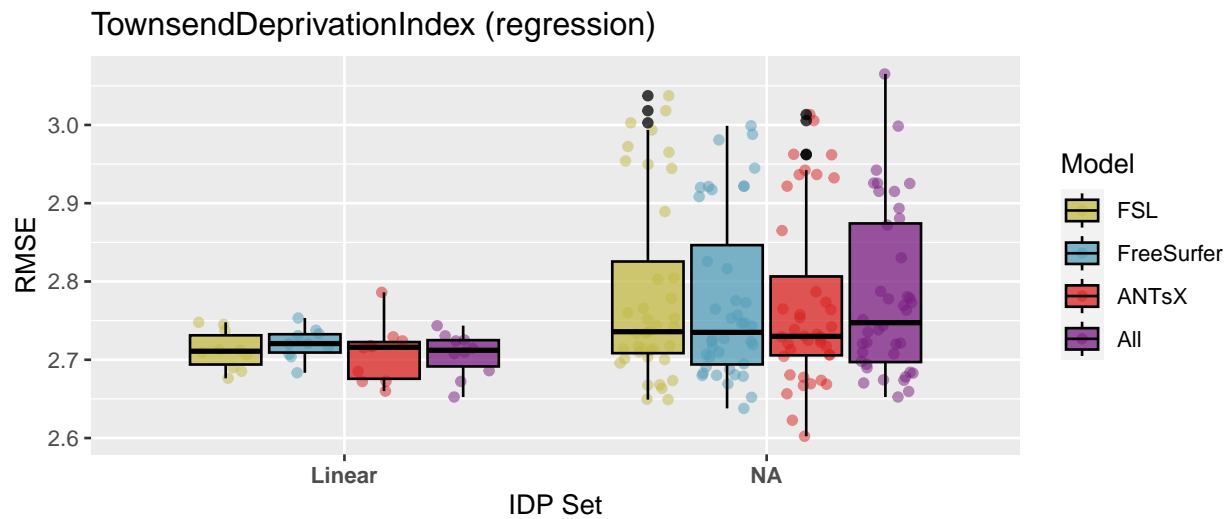


Figure 6: TownsendDeprivationIndex

6.1 Feature ranking: Linear

- FSL
 - range: [0.139757 , 12.48687]
 - std: 1.248796
 - skewness: 4.841903
- FreeSurfer
 - range: [0.1699931 , 3.64896]
 - std: 0.6524566
 - skewness: 1.065419
- ANTsX
 - range: [0.158075 , 3.297345]
 - std: 0.6863873
 - skewness: 1.076649

6.1.1 Package-based ranking (top 10 features)

- FSL: rank = 93 , imp = 44.74012
- FreeSurfer: rank = 233 , imp = 29.08779
- ANTsX: rank = 193 , imp = 29.35449

Table 6: TownsendDeprivationIndex

Package	Pipeline	Feature
FSL	FAST	Volume of grey matter in Amygdala (left)
FSL	Other	Continuous Volume of peripheral cortical grey matter
FSL	FAST	Volume of grey matter in Heschl's Gyrus (includes H1 and H2) (left)
FSL	Other	Continuous Volume of ventricular cerebrospinal fluid
FSL	Other	Continuous Volume of ventricular cerebrospinal fluid (normalised for head size)
FreeSurfer	ASEG	Volume of SupraTentorial (whole brain)
FreeSurfer	ASEG	Volume of VentralDC (left hemisphere)
FSL	FAST	Volume of grey matter in Heschl's Gyrus (includes H1 and H2) (right)
ANTsX	SYSU WMH	Left cerebellum
FreeSurfer	ASEG	Volume of TotalGray (whole brain)
FSL	FAST	Volume of grey matter in Superior Parietal Lobule (right)
FreeSurfer	Thickness	Mean thickness of superiorfrontal (right hemisphere)
ANTsX	Cereb	CerebellarGrayMatter volume
ANTsX	Cereb	L_III volume
ANTsX	Region	Right caudal anterior cingulate
ANTsX	Cortical	Left insula volume
FreeSurfer	ASEG	Volume of SupraTentorialNotVent (whole brain)
FSL	FAST	Volume of grey matter in Thalamus (left)
ANTsX	Thickness	Left superior parietal
FSL	FAST	Volume of grey matter in Inferior Temporal Gyrus - temporooccipital part (left)
FSL	FAST	Volume of grey matter in Frontal Pole (right)
FSL	FAST	Volume of grey matter in Planum Temporale (left)
ANTsX	Cereb	R_X volume
FreeSurfer	Thickness	Mean thickness of superiortemporal (left hemisphere)
FSL	FAST	Volume of grey matter in Occipital Fusiform Gyrus (left)

6.1.2 Package-based ranking (top 25 features)

- FSL: rank = 763 , imp = 80.4624
- FreeSurfer: rank = 1274 , imp = 60.26641
- ANTsX: rank = 891 , imp = 64.35683

6.1.3 Package-based ranking (top 50 features)

- FSL: rank = 4128 , imp = 121.9611
- FreeSurfer: rank = 4139 , imp = 104.0827
- ANTsX: rank = 3281 , imp = 111.1481

7 GeneticSex

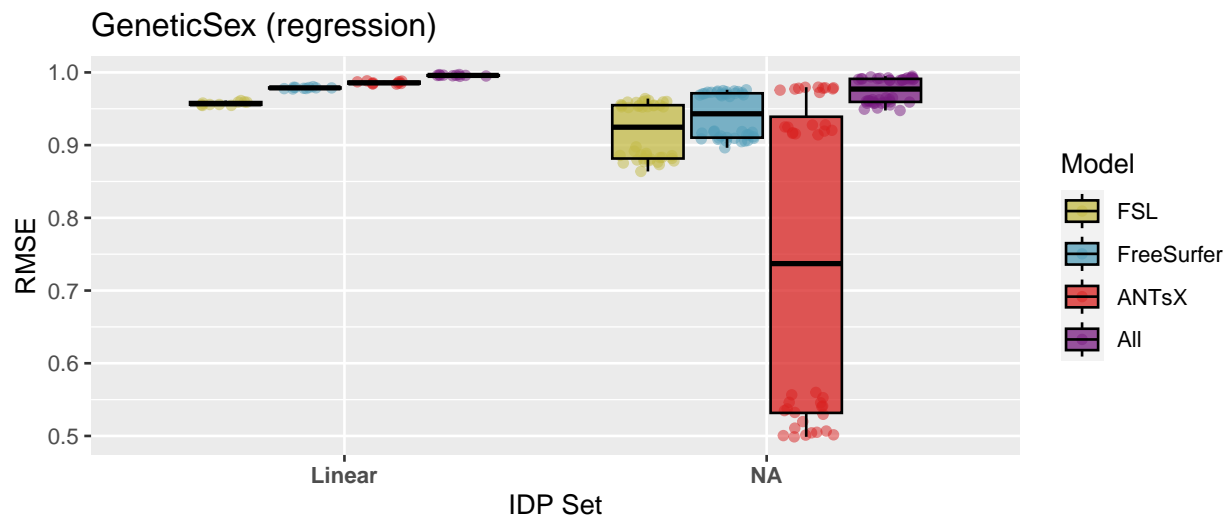


Figure 7: GeneticSex

7.1 Feature ranking: Linear

- FSL
 - range: [NA , NA]
 - std: NA
 - skewness: NA
- FreeSurfer
 - range: [0.1737775 , 10.24362]
 - std: 1.567378
 - skewness: 2.222905
- ANTsX
 - range: [0.1889526 , 10.59129]
 - std: 1.589695
 - skewness: 1.313573

7.1.1 Package-based ranking (top 10 features)

- FSL: rank = 305 , imp = 56.68502
- FreeSurfer: rank = 93 , imp = 74.87624
- ANTsX: rank = 158 , imp = 66.55404

Table 7: GeneticSex

Package	Pipeline	Feature
ANTsX	Atropos	DeepGrayMatter
FreeSurfer	HippAmyg	Volume of AV (right hemisphere)
FreeSurfer	ASEG	Volume of VentralDC (right hemisphere)
FreeSurfer	ASEG	Volume of CerebralWhiteMatter (left hemisphere)
ANTsX	Region	Left thalamus proper
FreeSurfer	ASEG	Volume of CerebralWhiteMatter (right hemisphere)
FreeSurfer	ASEG	Volume of Cortex (right hemisphere)
FreeSurfer	ASEG	Volume of Cortex (left hemisphere)
FreeSurfer	ASEG	Volume of CC-Central (whole brain)
FSL	FIRST	Volume of accumbens (left)
FSL	FAST	Volume of grey matter in Lateral Occipital Cortex - superior division (left)
ANTsX	Cortical	Right lateral occipital volume
FSL	FAST	Volume of grey matter in Frontal Medial Cortex (left)
ANTsX	Region	Right caudate
–	–	NA
FreeSurfer	Thickness	Mean thickness of paracentral (right hemisphere)
FreeSurfer	Volume	Volume of transversetemporal (left hemisphere)
ANTsX	Cereb	R_IX thickness
ANTsX	Cortical	Left parahippocampal volume
ANTsX	Cereb	R_VIIB thickness
FreeSurfer	HippAmyg	Volume of AV (left hemisphere)
ANTsX	Cortical	Right superior parietal volume
ANTsX	Cereb	CerebellarWhiteMatter volume
ANTsX	Region	Right inferior parietal
FSL	FAST	Volume of grey matter in Intracalcarine Cortex (right)

7.1.2 Package-based ranking (top 25 features)

- FSL: rank = 1498 , imp = 117.6986
- FreeSurfer: rank = 868 , imp = 146.3458
- ANTsX: rank = 781 , imp = 142.2774

7.1.3 Package-based ranking (top 50 features)

- FSL: rank = 5321 , imp = 194.8791
- FreeSurfer: rank = 4226 , imp = 228.9607
- ANTsX: rank = 2835 , imp = 243.0013

8 Hearing

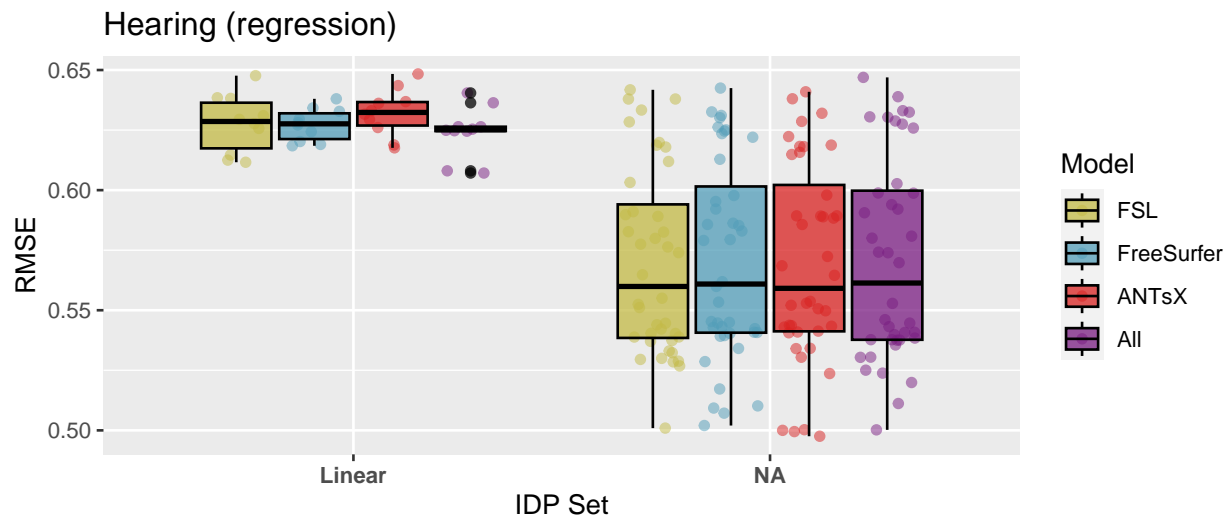


Figure 8: Hearing

8.1 Feature ranking: Linear

- FSL
 - range: [0.1400707 , 15.84752]
 - std: 1.370073
 - skewness: 7.933981
- FreeSurfer
 - range: [0.1609316 , 3.033436]
 - std: 0.6188603
 - skewness: 1.169872
- ANTsX
 - range: [0.09976114 , 3.424184]
 - std: 0.6634497
 - skewness: 1.186676

8.1.1 Package-based ranking (top 10 features)

- FSL: rank = 157 , imp = 41.91777
- FreeSurfer: rank = 195 , imp = 26.48697
- ANTsX: rank = 126 , imp = 28.82698

Table 8: Hearing

Package	Pipeline	Feature
FSL	FAST	Volume of grey matter in Amygdala (left)
FSL	FAST	Volume of grey matter in Amygdala (right)
ANTsX	Thickness	Right lingual
ANTsX	Cereb	L_IX volume
ANTsX	DeepFLASH	Left aLEC
ANTsX	Thickness	Left transverse temporal
FreeSurfer	Volume	Volume of caudalanteriorcingulate (left hemisphere)
FSL	FAST	Volume of grey matter in X Cerebellum (right)
FreeSurfer	Volume	Volume of medialorbitofrontal (left hemisphere)
FSL	FAST	Volume of grey matter in Temporal Fusiform Cortex - posterior division (left)
FreeSurfer	Thickness	Mean thickness of posteriorcingulate (right hemisphere)
FSL	Other	Continuous Volume of grey matter
FreeSurfer	Volume	Volume of paracentral (left hemisphere)
ANTsX	Region	Right thalamus proper
ANTsX	Cereb	L_Crus_I volume
ANTsX	Cereb	L_I_II volume
FreeSurfer	Volume	Volume of inferiorparietal (left hemisphere)
FreeSurfer	Thickness	Mean thickness of inferiorparietal (left hemisphere)
ANTsX	Cereb	R_VI volume
ANTsX	Region	Right caudate
FSL	FAST	Volume of grey matter in VI Cerebellum (right)
FSL	FAST	Volume of grey matter in Parahippocampal Gyrus - posterior division (left)
FSL	FAST	Volume of grey matter in Middle Temporal Gyrus - temporooccipital part (right)
ANTsX	Region	Right middle temporal
ANTsX	Cereb	L_Crus_II volume

8.1.2 Package-based ranking (top 25 features)

- FSL: rank = 1280 , imp = 70.92944
- FreeSurfer: rank = 933 , imp = 59.54118
- ANTsX: rank = 820 , imp = 62.38052

8.1.3 Package-based ranking (top 50 features)

- FSL: rank = 5838 , imp = 103.0179
- FreeSurfer: rank = 3514 , imp = 101.4115
- ANTsX: rank = 3120 , imp = 106.2714

9 RiskTaking

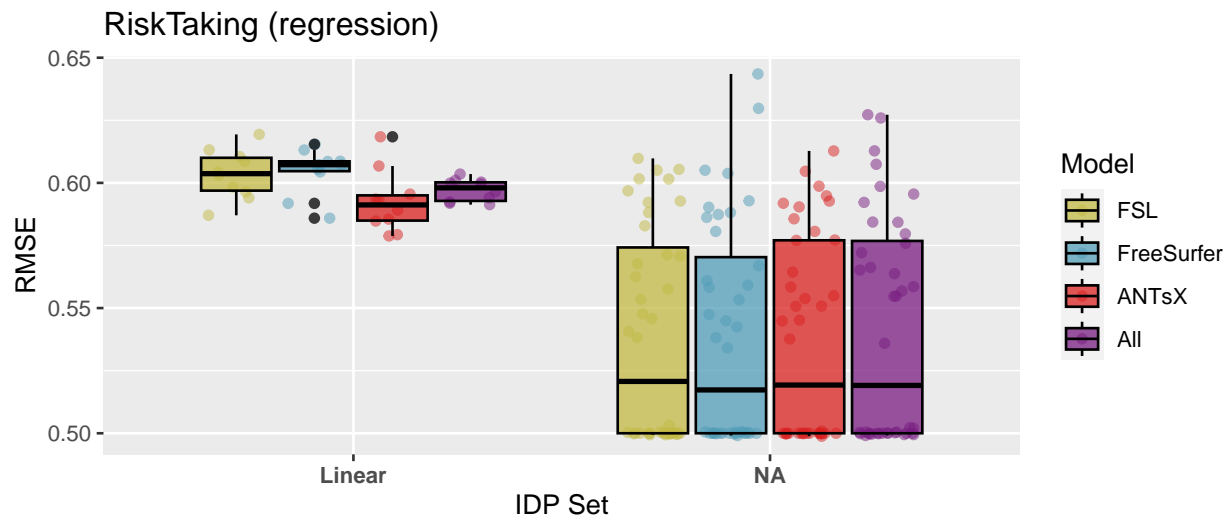


Figure 9: RiskTaking

9.1 Feature ranking: Linear

- FSL
 - range: [0.1795269 , 10.14113]
 - std: 0.9923587
 - skewness: 5.553114
- FreeSurfer
 - range: [0.1836498 , 3.657539]
 - std: 0.6951129
 - skewness: 0.6690752
- ANTsX
 - range: [0.1370474 , 2.901573]
 - std: 0.6013431
 - skewness: 0.9711023

9.1.1 Package-based ranking (top 10 features)

- FSL: rank = 261 , imp = 34.88583
- FreeSurfer: rank = 90 , imp = 30.03523
- ANTsX: rank = 250 , imp = 25.28125

Table 9: RiskTaking

Package	Pipeline	Feature
FSL	FAST	Volume of grey matter in Amygdala (right)
FSL	FAST	Volume of grey matter in Amygdala (left)
FreeSurfer	ASEG	Volume of BrainSeg (whole brain)
FSL	FAST	Volume of grey matter in Frontal Orbital Cortex (left)
FreeSurfer	Thickness	Mean thickness of parsorbitalis (left hemisphere)
FreeSurfer	HippAmyg	Volume of CL (left hemisphere)
FreeSurfer	HippAmyg	Volume of Hippocampal-tail (left hemisphere)
ANTsX	Thickness	Left caudal anterior cingulate
FreeSurfer	HippAmyg	Volume of parasubiculum (left hemisphere)
FreeSurfer	HippAmyg	Volume of presubiculum-body (left hemisphere)
FreeSurfer	HippAmyg	Volume of CA3-body (left hemisphere)
FreeSurfer	HippAmyg	Volume of CA4-body (left hemisphere)
FreeSurfer	HippAmyg	Volume of subiculum-body (left hemisphere)
FreeSurfer	HippAmyg	Volume of HATA (left hemisphere)
FSL	FAST	Volume of grey matter in Temporal Fusiform Cortex - anterior division (left)
FSL	FAST	Volume of grey matter in Intracalcarine Cortex (left)
FreeSurfer	Thickness	Mean thickness of lateralorbitofrontal (right hemisphere)
ANTsX	DeepFLASH	Right perirhinal
ANTsX	Cortical	Right pericalcarine volume
ANTsX	DeepFLASH	Right MTL
ANTsX	Region	Right pericalcarine
FreeSurfer	HippAmyg	Volume of AV (right hemisphere)
FreeSurfer	ASEG	Volume of Amygdala (left hemisphere)
FreeSurfer	ASEG	Volume of TotalGray (whole brain)
FreeSurfer	Thickness	Mean thickness of entorhinal (left hemisphere)

9.1.2 Package-based ranking (top 25 features)

- FSL: rank = 2255 , imp = 59.555
- FreeSurfer: rank = 552 , imp = 65.86192
- ANTsX: rank = 1073 , imp = 55.84686

9.1.3 Package-based ranking (top 50 features)

- FSL: rank = 8514 , imp = 90.72164
- FreeSurfer: rank = 2525 , imp = 111.9594
- ANTsX: rank = 3945 , imp = 97.4797

10 SameSexIntercourse



Figure 10: SameSexIntercourse

10.1 Feature ranking: Linear

- FSL
 - range: [0.09777208 , 8.065794]
 - std: 0.7925432
 - skewness: 4.774372
- FreeSurfer
 - range: [0.177841 , 3.047648]
 - std: 0.4620206
 - skewness: 1.247426
- ANTsX
 - range: [0.1354761 , 2.923016]
 - std: 0.591493
 - skewness: 1.252716

10.1.1 Package-based ranking (top 10 features)

- FSL: rank = 234 , imp = 27.48743
- FreeSurfer: rank = 329 , imp = 21.42504
- ANTsX: rank = 84 , imp = 25.76776

Table 10: SameSexIntercourse

Package	Pipeline	Feature
FSL	FAST	Volume of grey matter in Amygdala (left)
FreeSurfer	ASEG	Volume of CC-Mid-Anterior (whole brain)
ANTsX	SYSU WMH	Left brain stem
ANTsX	Region	Left lingual
ANTsX	Region	Right ventral DC
ANTsX	Region	CSF
FreeSurfer	ASEG	Volume of Optic-Chiasm (whole brain)
ANTsX	Thickness	Left rostral anterior cingulate
ANTsX	Region	Cerebellar vermal lobules VI VII
ANTsX	Cortical	Left lingual volume
FSL	FAST	Volume of grey matter in Planum Polare (left)
ANTsX	Thickness	Right lateral orbitofrontal
ANTsX	Thickness	Right lateral occipital
ANTsX	Region	Left pars triangularis
ANTsX	Cortical	Left rostral anterior cingulate volume
FreeSurfer	ASEG	Volume of non-WM-hypointensities (whole brain)
FSL	Other	Continuous Volume of peripheral cortical grey matter (normalised for head size)
ANTsX	Cereb	R_IV thickness
FreeSurfer	ASEG	Volume of Pallidum (left hemisphere)
FreeSurfer	ASEG	Volume of Lateral-Ventricle (left hemisphere)
FSL	FAST	Volume of grey matter in Superior Frontal Gyrus (right)
FSL	FAST	Volume of grey matter in Frontal Medial Cortex (left)
ANTsX	Region	Left putamen
ANTsX	Thickness	Left lateral occipital
ANTsX	Thickness	Right superior frontal

10.1.2 Package-based ranking (top 25 features)

- FSL: rank = 1130 , imp = 53.00098
- FreeSurfer: rank = 1717 , imp = 43.43501
- ANTsX: rank = 543 , imp = 56.88152

10.1.3 Package-based ranking (top 50 features)

- FSL: rank = 4806 , imp = 84.5719
- FreeSurfer: rank = 5014 , imp = 76.10665
- ANTsX: rank = 2298 , imp = 97.2722

11 Smoking

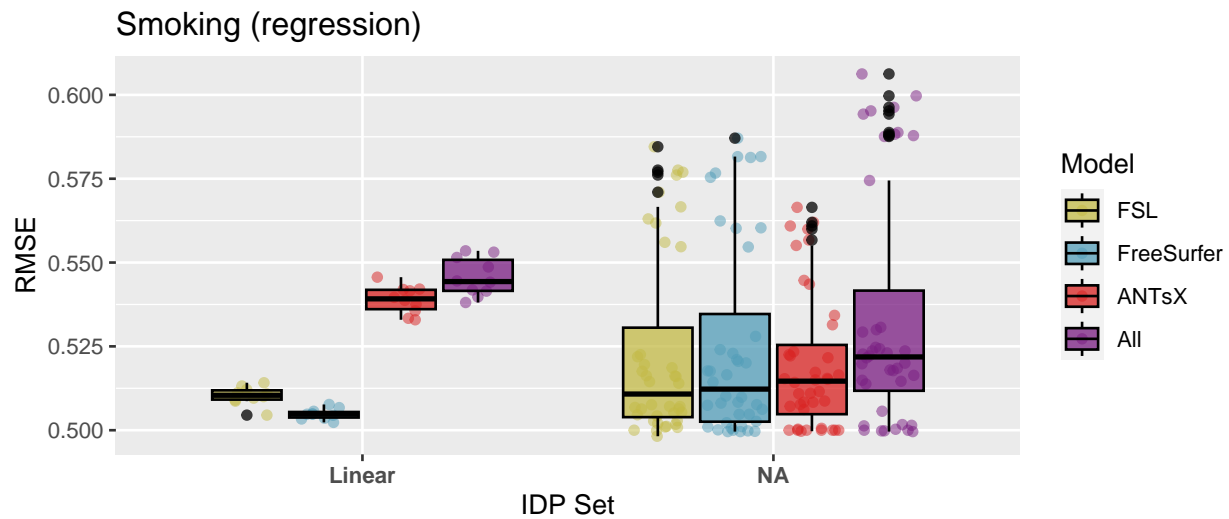


Figure 11: Smoking

11.1 Feature ranking: Linear

- FSL
 - range: [0.0000000004780733 , 0.04568151]
 - std: 0.005543492
 - skewness: 4.73262
- FreeSurfer
 - range: [0 , 0.3827131]
 - std: 0.03270468
 - skewness: 8.254631
- ANTsX
 - range: [0.000000000000009869648 , 0.02975863]
 - std: 0.004373508
 - skewness: 3.083098

11.1.1 Package-based ranking (top 10 features)

- FSL: rank = 300 , imp = 0.2110577
- FreeSurfer: rank = 56 , imp = 1.461918
- ANTsX: rank = 262 , imp = 0.2076409

Table 11: Smoking

Package	Pipeline	Feature
FreeSurfer	ASEG	Volume of CC-Central (whole brain)
FreeSurfer	ASEG	Volume of BrainSegNotVentSurf (whole brain)
FreeSurfer	ASEG	Volume of VentralDC (right hemisphere)
FreeSurfer	ASEG	Volume of Cortex (right hemisphere)
FreeSurfer	ASEG	Volume of Cortex (left hemisphere)
FreeSurfer	ASEG	Volume of CC-Anterior (whole brain)
FreeSurfer	ASEG	Volume of Optic-Chiasm (whole brain)
FreeSurfer	ASEG	Volume of SupraTentorialNotVent (whole brain)
FreeSurfer	ASEG	Volume of Thalamus-Propor (right hemisphere)
FSL	Other	Continuous Volume of brain stem + 4th ventricle
FreeSurfer	ASEG	Volume of Pallidum (left hemisphere)
–	–	NA
FreeSurfer	ASEG	Volume of CerebralWhiteMatter (left hemisphere)
FreeSurfer	Thickness	Mean thickness of caudalanteriorcingulate (left hemisphere)
ANTsX	Cortical	Left superior frontal volume
FSL	Other	Continuous Volume of ventricular cerebrospinal fluid
FreeSurfer	ASEG	Volume of EstimatedTotalIntraCranial (whole brain)
FreeSurfer	ASEG	Volume of Thalamus-Propor (left hemisphere)
ANTsX	Atropos	BrainStem
FSL	Other	Continuous Volume of brain = grey+white matter (normalised for head size)
ANTsX	Atropos	WhiteMatter
FreeSurfer	ASEG	Volume of CerebralWhiteMatter (right hemisphere)
FSL	Other	Continuous Volume of grey matter
FSL	Other	Continuous Volume of white matter
FSL	Other	Continuous Volume of grey matter (normalised for head size)

11.1.2 Package-based ranking (top 25 features)

- FSL: rank = 1886 , imp = 0.2870485
- FreeSurfer: rank = 607 , imp = 1.719945
- ANTsX: rank = 977 , imp = 0.3637066

11.1.3 Package-based ranking (top 50 features)

- FSL: rank = 6707 , imp = 0.3520102
- FreeSurfer: rank = 3375 , imp = 1.842075
- ANTsX: rank = 3086 , imp = 0.5167613

12 Alcohol

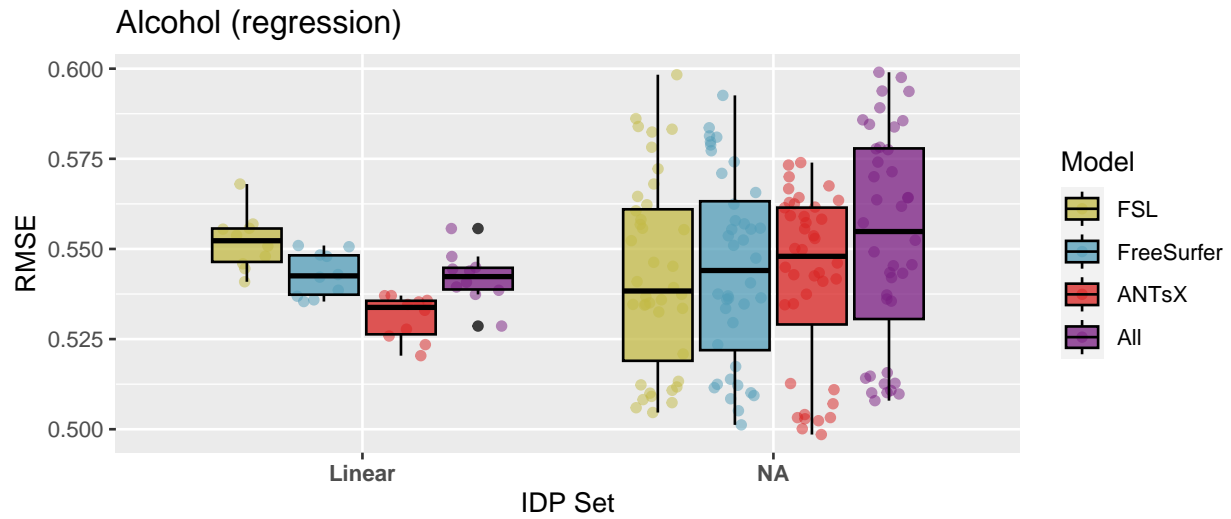


Figure 12: Alcohol

12.1 Feature ranking: Linear

- FSL
 - range: [0.0000000001192476 , 0.06011407]
 - std: 0.007067126
 - skewness: 5.058123
- FreeSurfer
 - range: [0 , 0.1692415]
 - std: 0.01298998
 - skewness: 8.804126
- ANTsX
 - range: [0 , 0.09457359]
 - std: 0.007797607
 - skewness: 7.256026

12.1.1 Package-based ranking (top 10 features)

- FSL: rank = 233 , imp = 0.2657077
- FreeSurfer: rank = 116 , imp = 0.5770373
- ANTsX: rank = 177 , imp = 0.3491997

Table 12: Alcohol

Package	Pipeline	Feature
FreeSurfer	ASEG	Volume of Thalamus-Proper (right hemisphere)
ANTsX	Atropos	DeepGrayMatter
FreeSurfer	ASEG	Volume of Pallidum (left hemisphere)
–	–	NA
FreeSurfer	ASEG	Volume of Cortex (left hemisphere)
FSL	Other	Continuous Volume of brain = grey+white matter
FreeSurfer	ASEG	Volume of Hippocampus (left hemisphere)
ANTsX	Cereb	CerebellarGrayMatter volume
FreeSurfer	ASEG	Volume of CC-Central (whole brain)
ANTsX	Region	Right cerebellum white matter
FSL	Other	Continuous Volume of ventricular cerebrospinal fluid (normalised for head size)
FreeSurfer	ASEG	Volume of VentralDC (right hemisphere)
FreeSurfer	ASEG	Volume of Thalamus-Proper (left hemisphere)
FSL	Other	Continuous Volume of ventricular cerebrospinal fluid
ANTsX	Region	Left amygdala
FreeSurfer	ASEG	Volume of BrainSegNotVentSurf (whole brain)
ANTsX	Cortical	Left lingual volume
FSL	Other	Continuous Volume of brain = grey+white matter (normalised for head size)
FSL	Other	Continuous Volume of brain stem + 4th ventricle
ANTsX	Region	Left cerebellum white matter
FSL	Other	Continuous Volume of white matter
FSL	Other	Continuous Volume of white matter (normalised for head size)
ANTsX	Cortical	Left superior temporal volume
FreeSurfer	ASEG	Volume of choroid-plexus (left hemisphere)
ANTsX	Region	Left transverse temporal

12.1.2 Package-based ranking (top 25 features)

- FSL: rank = 1447 , imp = 0.3594325
- FreeSurfer: rank = 869 , imp = 0.7370469
- ANTsX: rank = 840 , imp = 0.5216603

12.1.3 Package-based ranking (top 50 features)

- FSL: rank = 4873 , imp = 0.4520167
- FreeSurfer: rank = 4545 , imp = 0.8297048
- ANTsX: rank = 2926 , imp = 0.675435

