

# Validation results

This document lists detailed evaluation metrics for the MIMIR inference engine<sup>1</sup> for image-based deep regression on UK Biobank data. All listed metrics resulted from 10-fold cross-validation.

## 1 Evaluation Metrics

The tables contain the following columns:

<b>Description</b>	A descriptive term for the estimated measurement or property, taken either from the UK Biobank Showcase or assigned from external sources
<b>Field</b>	The UK Biobank field ID (Left blank if the reference values were not obtained from UK Biobank)
<b>N</b>	Number of subjects
<b>Unit</b>	Measurement unit
<b>ICC</b>	Intraclass correlation coefficient, using a two-way random, single measures, absolute agreement definition
<b>R<sup>2</sup></b>	Coefficient of determination
<b>MAE</b>	Mean absolute error
<b>MAPE</b>	Mean absolute percentage error <sup>3</sup>

Additional documentation on each target can be found by searching for a given field ID in the publicly accessible UK Biobank showcase:

<https://biobank.ndph.ox.ac.uk/showcase/search.cgi>

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<sup>1</sup>[https://github.com/tarolangner/ukb\\_mimir/](https://github.com/tarolangner/ukb_mimir/)

<sup>3</sup>Defined as the average of absolute differences between reference and prediction, divided by the reference. To avoid division by zero, reference values smaller than an epsilon of 0.0001 were excluded

Table 1: Anthropometry and Other Estimates

Description	Field	N	Unit	ICC	R <sup>2</sup>	MAE	MAPE
gripStrengthRight	47	37,603	kg	0.756	0.609	5.039	19.6
height	12144	38,874	cm	0.965	0.932	1.794	1.1
hip	49	37,777	cm	0.916	0.845	2.616	2.6
pulseRate	102	31,437	bpm	0.193	0.111	8.897	13.2
sex	31	38,874	(male = 1)	0.999	0.998	0.004	0.4
sittingHeight	20015	37,586	cm	0.920	0.852	1.249	1.4
waist	48	37,775	cm	0.937	0.881	3.386	3.9
weight	21002	37,705	kg	0.997	0.994	0.878	1.2

Table 2: Abdominal Organs

Description	Field	N	Unit	ICC	R <sup>2</sup>	MAE	MAPE
AtlasLiverFat	22436	9,538	%	0.977	0.955	0.699	26.5
liverFat	22402	4,415	%	0.959	0.921	0.789	35.4
kidneyParenchymalVolume	/	36,941	L	0.912	0.834	0.017	7.0
liverVolume	/	36,332	L	0.986	0.971	0.039	2.8

Table 3: Age

Description	Field	N	Unit	ICC	R <sup>2</sup>	MAE	MAPE
age	/	37897	years	0.896	0.807	2.627	4.1

Table 4: Body Composition, Atlas-based

Description	Field	N	Unit	ICC	R <sup>2</sup>	MAE	MAPE
AtlasAbdominalFatRatio	22434	9499	L/L	0.997	0.993	0.007	1.5
AtlasAnteriorThighLeanMuscleLeft	22405	5602	L	0.983	0.966	0.066	3.9
AtlasAnteriorThighLeanMuscleRight	22403	5657	L	0.984	0.969	0.064	3.8
AtlasAsatVolume	22408	9629	L	0.995	0.990	0.221	3.2
AtlasMuscleFat	22435	9439	%	0.963	0.928	0.369	5.0
AtlasPosteriorThighLeanMuscleLeft	22406	5602	L	0.989	0.978	0.091	2.7
AtlasPosteriorThighLeanMuscleRight	22404	5657	L	0.990	0.980	0.087	2.6
AtlasTotalAbdominalAdiposeTissueIndex	22432	9628	L/m <sup>2</sup>	0.996	0.992	0.106	2.9
AtlasTotalAdiposeTissueVolume	22415	8270	L	0.997	0.993	0.410	2.0
AtlasTotalLeanTissueVolume	22416	8270	L	0.982	0.965	0.615	2.6
AtlasTotalThighMuscleVolume	22409	9514	L	0.996	0.992	0.172	1.7
AtlasTotalTrunkFat	22410	5758	L	0.997	0.994	0.246	2.4
AtlasVatVolume	22407	9628	L	0.995	0.991	0.155	5.2
AtlasWeightToMuscleRatio	22433	9514	kg/L	0.975	0.952	0.179	2.3

Table 5: Body Composition, DXA, Part One

Description	Field	N	Unit	ICC	R <sup>2</sup>	MAE	MAPE
DxaAndroidBoneMass	23244	4541	g	0.719	0.561	6.579	13.7
DxaAndroidFatMass	23245	4541	kg	0.990	0.980	0.118	5.6
DxaAndroidLeanMass	23246	4541	kg	0.970	0.942	0.139	4.2
DxaAndroidTissueFatPercentage	23247	4541	%	0.986	0.973	1.351	3.8
DxaAndroidTotalMass	23248	4541	kg	0.985	0.971	0.205	3.7
DxaArmFatMassLeft	23249	3831	kg	0.928	0.866	0.126	9.4
DxaArmFatMassRight	23253	3831	kg	0.929	0.868	0.124	9.0
DxaArmLeanMassLeft	23250	3831	kg	0.968	0.938	0.151	6.0
DxaArmLeanMassRight	23254	3831	kg	0.969	0.940	0.153	5.7
DxaArmsFatMass	23257	4541	kg	0.934	0.877	0.233	8.7
DxaArmsLeanMass	23258	4541	kg	0.974	0.950	0.274	5.3
DxaArmsTissueFatPercentage	23259	4541	%	0.975	0.950	1.668	5.2
DxaArmsTotalMass	23260	4541	kg	0.949	0.903	0.444	5.4
DxaArmTissueFatPercentageLeft	23251	3831	%	0.971	0.943	1.849	5.7
DxaArmTissueFatPercentageRight	23255	3831	%	0.972	0.945	1.745	5.5
DxaArmTotalMassLeft	23252	3831	kg	0.941	0.888	0.244	6.0
DxaArmTotalMassRight	23256	3831	kg	0.942	0.891	0.244	5.7
DxaGynoidBoneMass	23261	4541	g	0.907	0.830	21.232	7.8
DxaGynoidFatMass	23262	4541	kg	0.988	0.977	0.147	4.1
DxaGynoidLeanMass	23263	4541	kg	0.987	0.975	0.183	2.8
DxaGynoidTissueFatPercentage	23264	4541	%	0.991	0.981	0.958	2.8
DxaGynoidTotalMass	23265	4541	kg	0.986	0.973	0.238	2.3
DxaLegFatMassLeft	23266	3831	kg	0.986	0.972	0.174	4.6
DxaLegFatMassRight	23270	3831	kg	0.986	0.973	0.173	4.5
DxaLegLeanMassLeft	23267	3831	kg	0.980	0.961	0.271	3.4
DxaLegLeanMassRight	23271	3831	kg	0.981	0.964	0.266	3.3
DxaLegsFatMass	23274	4541	kg	0.988	0.977	0.306	4.2
DxaLegsLeanMass	23275	4541	kg	0.984	0.970	0.477	3.1
DxaLegsTissueFatPercentage	23276	4541	%	0.991	0.983	0.964	3.2
DxaLegsTotalMass	23277	4541	kg	0.982	0.965	0.615	2.6
DxaLegTissueFatPercentageLeft	23268	3831	%	0.990	0.980	1.075	3.6
DxaLegTissueFatPercentageRight	23272	3831	%	0.990	0.980	1.062	3.5

Table 6: Body Composition, DXA, Part Two

Description	Field	N	Unit	ICC	R <sup>2</sup>	MAE	MAPE
DxaLegTotalMassLeft	23269	3831	kg	0.978	0.957	0.356	2.9
DxaLegTotalMassRight	23273	3831	kg	0.978	0.958	0.349	2.8
DxaTotalFatFreeMass	23279	4541	kg	0.993	0.987	0.807	1.7
DxaTotalFatMass	23278	4541	kg	0.995	0.990	0.581	2.6
DxaTotalLeanMass	23280	4541	kg	0.993	0.987	0.780	1.8
DxaTotalTissueFatPercentage	23281	4541	%	0.994	0.987	0.686	2.0
DxaTotalTissueMass	23282	4541	kg	0.994	0.989	0.866	1.3
DxaTrunkFatMass	23284	4541	kg	0.993	0.986	0.480	3.8
DxaTrunkLeanMass	23285	4541	kg	0.984	0.969	0.572	2.7
DxaTrunkTissueFatPercentage	23286	4541	%	0.990	0.981	0.975	2.7
DxaTrunkTotalMass	23287	4541	kg	0.991	0.983	0.754	2.2
DxaVatVolume	23289	4495	L	0.983	0.968	0.124	24.4