

## Supplementary Materials: Multimodal Multitask Deep Learning for X-Ray Image Retrieval

**Table S1.** Hyperparameters for Model Training.

Training networks	Learning Deep Descriptors	Ranking Loss Optimization	Multimodal Multitask Retrieval
Optimizers selection	ADAM	ADAM	ADAM
Learning rate	$10^{-4}$	$5e^{-6}$	$10^{-4}$
$\beta$	[0.9, 0.999]	[0.9, 0.999]	[0.9, 0.999]
$\epsilon$	$10^{-8}$	$10^{-8}$	$10^{-8}$
Weight decay	$10^{-5}$	$10^{-5}$	$10^{-5}$
Batch size	64	64	128

**Table S2.** Additional Performance Metrics for MMDL and Baseline Approaches

Training dataset and Retrieval Network	Image - D121	Image - MMDL	Image + report - MMDL	Image - ATH	Image - ATH and MMDL
Query format	Image	Image	Image	Image	Image
mAP (Top-1)	0.579	0.618	<b>0.630</b>	0.435	0.450
mAP (Top-5)	0.655	0.690	<b>0.703</b>	0.544	0.560
mAP (Top-10)	0.643	0.650	<b>0.683</b>	0.515	0.541
mAP (Top-20)	0.619	0.627	<b>0.658</b>	0.478	0.515
mAP (Top-k)	0.458	0.517	<b>0.525</b>	0.341	0.404
Accuracy (Top-1)	0.407	0.508	<b>0.513</b>	0.400	0.503
Accuracy (Top-5)	0.798	0.834	<b>0.863</b>	0.786	0.821

**Table S3.** Results from Ablation Studies for Unimodal Retrieval

Training dataset and Retrieval Network	Image – MMDL	Image – MMDL (with Deep Descriptors)	Image – MMDL (with Ranking Loss)
Query format	Image	Image	Image
All Samples	0.645	0.646	0.648
No Findings	0.701	0.702	0.706
Enlarged Cardiom	0.556	0.561	0.578
Cardiomegaly	0.674	0.691	0.712
Lung Opacity	0.634	0.647	0.668
Lung Lesion	0.301	0.323	0.365
Edema	0.751	0.759	0.763
Consolidation	0.671	0.678	0.709
Pneumonia	0.521	0.531	0.553
Atelectasis	0.670	0.693	0.717
Pneumothorax	0.698	0.701	0.706
Pleural Effusion	0.794	0.803	0.821
Pleural Other	0.341	0.343	0.348
Fracture	0.153	0.164	0.197
Support Device	0.797	0.808	0.819

**Table S4.** Results from Ablation Studies for Multimodal Retrieval.

Training dataset and Retrieval Network	Image + report – MMDL	Image + report – MMDL (with Deep Descriptors)	Image + report – MMDL (with Ranking Loss)
Query format	Image	Image	Image
All Samples	0.663	0.667	0.678
No Findings	0.723	0.729	0.749
Enlarged Cardiom	0.613	0.619	0.641
Cardiomegaly	0.735	0.736	0.741
Lung Opacity	0.712	0.714	0.717
Lung Lesion	0.408	0.413	0.420
Edema	0.786	0.787	0.790
Consolidation	0.724	0.723	0.725
Pneumonia	0.578	0.580	0.586
Atelectasis	0.742	0.747	0.754
Pneumothorax	0.738	0.742	0.751
Pleural Effusion	0.841	0.842	0.849
Pleural Other	0.389	0.393	0.421
Fracture	0.143	0.145	0.153
Support Device	0.841	0.844	0.854