Table 7.1: Results of the proposed data augmentation applied in combination with the traditional data augmentation techniques in the unified training set. The images were generated considering the minimum saliency distance between the image generated by the GAN and the lesion image from the dataset. The lesions are placed in the same lung side from the original image from the dataset. The values highlighted in green show the data augmentation techniques in which the P-value achieved values lower than 0.05, and thus the null hypothesis was rejected (i.e., there is a statistical difference and the results achieved are better than without data augmentation). The blue-colored values indicate the best F-score values, and the red-colored values indicate the best IoU values. The underscored values show the techniques in which the proposed augmentation combined with the traditional data augmentation techniques achieved a P-value lower than 0.05 when compared to just applying the generic data augmentation techniques, and the null hypothesis was rejected.

GAN	**Augmentation**	**CC-CCII**		**MedSeg**		**MosMed**		**Ricord1a**		**Zenodo**	
		F-score	IoU	F-score	IoU	F-score	IoU	F-score	IoU	F-score	IoU
	No Augmentation	0.8636	0.8087	0.8881	0.8253	0.8185	0.7547	0.8599	0.7947	0.9096	0.8514
Stargan	CLAHE	0.8556	0.8000	0.8917	0.8296	0.8323	0.7682	0.8815	0.8195	0.9121	0.8551
	Coarse Dropout	0.8675	0.8123	0.8957	0.8353	0.8410	0.7779	0.8816	0.8208	0.9148	0.8584
	Elastic Transform	0.8789	0.8274	**0.9001**	**0.8407**	0.8528	0.7897	0.8753	0.8130	0.9159	0.8597
	Emboss	0.8632	0.8091	0.8936	0.8328	0.8271	0.7625	0.8789	0.8171	0.9139	0.8570
	Flip	0.8709	0.8160	0.8965	0.8355	0.8483	0.7862	0.8683	0.8045	0.9114	0.8532
	Gaussian Blur	0.8642	0.8084	0.8943	0.8335	0.8273	0.7643	**0.8825**	**0.8212**	0.9155	0.8595
	Grid Distortion	0.8759	0.8241	0.8993	0.8395	0.8505	0.7867	0.8760	0.8137	0.9159	0.8596
	Grid Dropout	0.8674	0.8114	0.8928	0.8318	0.8371	0.7738	0.8785	0.8166	0.9122	0.8548
	Image Compression	0.8655	0.8105	0.8936	0.8323	0.8306	0.7669	0.8817	0.8206	0.9138	0.8573
	Median Blur	0.8654	0.8099	0.8930	0.8319	0.8225	0.7599	0.8797	0.8183	0.9155	0.8595
	Optical Distortion	0.8742	0.8194	0.8964	0.8363	0.8412	0.7790	0.8793	0.8177	**0.9168**	**0.8610**
	Piecewise Affine	0.8755	0.8232	0.8978	0.8379	0.8493	0.7867	0.8745	0.8119	0.9148	0.8581
	Posterize	0.8621	0.8065	0.8938	0.8319	0.8323	0.7687	0.8783	0.8164	0.9142	0.8575
	RBC	0.8586	0.8026	0.8931	0.8313	0.8326	0.7691	0.8773	0.8152	0.9123	0.8547
	Random Crop	0.8629	0.8073	0.8922	0.8300	0.8304	0.7673	0.8791	0.8176	0.9125	0.8553
	Random Gamma	0.8655	0.8096	0.8926	0.8308	0.8330	0.7694	0.8797	0.8179	0.9131	0.8561
	Random Snow	0.8666	0.8103	0.8950	0.8333	0.8416	0.7782	0.8785	0.8160	0.9140	0.8572
	Rotate	**0.8792**	**0.8255**	0.8989	0.8388	**0.8551**	**0.7912**	0.8666	0.8028	0.9116	0.8535
	Sharpen	0.8643	0.8087	0.8963	0.8349	0.8290	0.7647	0.8803	0.8189	0.9156	0.8595
	Shift Scale Rotate	0.8771	0.8251	0.8990	0.8394	0.8539	0.7902	0.8712	0.8080	0.9157	0.8590
Stylegan	CLAHE	0.8593	0.8034	0.8926	0.8305	0.8318	0.7689	0.8822	0.8203	0.9125	0.8552
	Coarse Dropout	0.8660	0.8110	0.8957	0.8351	0.8422	0.7790	0.8802	0.8190	0.9141	0.8578
	Elastic Transform	0.8772	0.8259	**0.9013**	**0.8415**	0.8518	0.7895	0.8752	0.8127	0.9154	0.8591
	Emboss	0.8671	0.8122	0.8941	0.8331	0.8264	0.7631	0.8787	0.8174	0.9140	0.8572
	Flip	0.8727	0.8186	0.8989	0.8379	0.8469	0.7847	0.8668	0.8030	0.9110	0.8524
	Gaussian Blur	0.8625	0.8070	0.8948	0.8339	0.8258	0.7626	0.8819	0.8207	0.9145	0.8581
	Grid Distortion	0.8763	0.8241	0.9001	0.8403	0.8564	0.7932	0.8765	0.8145	0.9158	0.8596
	Grid Dropout	0.8652	0.8097	0.8928	0.8314	0.8348	0.7717	0.8773	0.8156	0.9120	0.8548
	Image Compression	0.8661	0.8106	0.8937	0.8324	0.8312	0.7681	0.8803	0.8193	0.9142	0.8574
	Median Blur	0.8634	0.8084	0.8949	0.8339	0.8318	0.7696	0.8829	0.8216	**0.9161**	**0.8602**
	Optical Distortion	0.8736	0.8199	0.8994	0.8391	0.8333	0.7708	0.8809	0.8195	0.9160	0.8601
	Piecewise Affine	0.8769	0.8245	0.8999	0.8398	**0.8574**	**0.7947**	0.8777	0.8158	0.9156	0.8593
	Posterize	0.8671	0.8105	0.8958	0.8340	0.8300	0.7667	0.8797	0.8180	0.9143	0.8576
	RBC	0.8591	0.8024	0.8976	0.8360	0.8357	0.7724	0.8785	0.8162	0.9125	0.8554
	Random Crop	0.8624	0.8066	0.8899	0.8281	0.8276	0.7643	0.8782	0.8167	0.9126	0.8551
	Random Gamma	0.8651	0.8083	0.8909	0.8287	0.8277	0.7635	0.8791	0.8176	0.9124	0.8549
	Random Snow	0.8717	0.8150	0.8928	0.8310	0.8411	0.7771	0.8776	0.8149	0.9135	0.8565
	Rotate	**0.8808**	**0.8271**	0.8993	0.8394	0.8553	0.7925	0.8664	0.8026	0.9129	0.8551
	Sharpen	0.8646	0.8089	0.8949	0.8334	0.8354	0.7711	**0.8851**	0.8242	0.9151	0.8592
	Shift Scale Rotate	0.8790	0.8267	0.8989	0.8391	0.8569	0.7935	0.8726	0.8096	0.9144	0.8574

Table 7.2: Results of the proposed data augmentation applied in combination with the traditional data augmentation techniques in the unified training set. The images were generated considering the minimum saliency distance between the image generated by the GAN and the lesion image from the dataset. The lesions are placed in the opposite lung side from the original image from the dataset. The values highlighted in green show the data augmentation techniques in which the P-value achieved values lower than 0.05, and thus the null hypothesis was rejected (i.e., there is a statistical difference and the results achieved are better than without data augmentation). The blue-colored values indicate the best F-score values, and the red-colored values indicate the best IoU values. The underscored values show the techniques in which the proposed augmentation combined with the traditional data augmentation techniques achieved a P-value lower than 0.05 when compared to just applying the generic data augmentation techniques, and the null hypothesis was rejected.

GAN	**Augmentation**	**CC-CCII**		**MedSeg**		**MosMed**		**Ricord1a**		**Zenodo**	
		F-score	IoU	F-score	IoU	F-score	IoU	F-score	IoU	F-score	IoU
	No Augmentation	0.8636	0.8087	0.8881	0.8253	0.8185	0.7547	0.8599	0.7947	0.9096	0.8514
Stargan	CLAHE	0.8540	0.7987	0.8912	0.8285	0.8302	0.7670	0.8790	0.8174	0.9120	0.8548
	Coarse Dropout	0.8654	0.8115	0.8935	0.8329	0.8356	0.7724	0.8791	0.8177	0.9139	0.8573
	Elastic Transform	0.8782	0.8268	0.8996	0.8400	0.8502	0.7878	0.8758	0.8138	0.9162	0.8599
	Emboss	0.8667	0.8126	0.8943	0.8332	0.8339	0.7697	0.8827	0.8220	0.9150	0.8586
	Flip	0.8723	0.8181	0.8944	0.8330	0.8488	0.7866	0.8675	0.8037	0.9107	0.8520
	Gaussian Blur	0.8628	0.8082	0.8957	0.8354	0.8255	0.7617	0.8819	0.8208	0.9150	0.8589
	Grid Distortion	0.8762	0.8239	**0.9004**	**0.8409**	0.8507	0.7878	0.8755	0.8132	**0.9163**	0.8600
	Grid Dropout	0.8634	0.8086	0.8943	0.8325	0.8389	0.7754	0.8764	0.8147	0.9122	0.8547
	Image Compression	0.8665	0.8108	0.8943	0.8326	0.8342	0.7714	0.8803	0.8191	0.9152	0.8589
	Median Blur	0.8642	0.8094	0.8945	0.8334	0.8329	0.7693	0.8815	0.8203	**0.9163**	**0.8607**
	Optical Distortion	0.8723	0.8190	0.8965	0.8361	0.8355	0.7727	0.8784	0.8170	0.9158	0.8598
	Piecewise Affine	0.8772	0.8255	0.8983	0.8383	0.8524	0.7903	0.8761	0.8137	0.9149	0.8584
	Posterize	0.8642	0.8086	0.8952	0.8337	0.8287	0.7653	0.8779	0.8158	0.9145	0.8579
	RBC	0.8599	0.8039	0.8951	0.8333	0.8359	0.7712	0.8758	0.8134	0.9125	0.8552
	Random Crop	0.8651	0.8089	0.8917	0.8299	0.8283	0.7654	0.8786	0.8168	0.9134	0.8564
	Random Gamma	0.8634	0.8082	0.8911	0.8292	0.8293	0.7654	0.8798	0.8181	0.9134	0.8563
	Random Snow	0.8675	0.8117	0.8930	0.8316	0.8412	0.7772	0.8752	0.8126	0.9142	0.8575
	Rotate	**0.8812**	**0.8285**	0.8988	0.8391	0.8578	0.7942	0.8667	0.8030	0.9125	0.8546
	Sharpen	0.8619	0.8067	0.8949	0.8341	0.8304	0.7668	**0.8838**	**0.8226**	0.9151	0.8592
	Shift Scale Rotate	0.8773	0.8251	0.8986	0.8394	**0.8600**	**0.7968**	0.8742	0.8114	0.9157	0.8593
Stylegan	CLAHE	0.8594	0.8022	0.8939	0.8314	0.8329	0.7696	0.8797	0.8184	0.9133	0.8563
	Coarse Dropout	0.8662	0.8117	0.8963	0.8360	0.8376	0.7740	0.8798	0.8185	0.9146	0.8580
	Elastic Transform	0.8793	0.8278	**0.9006**	**0.8413**	0.8486	0.7862	0.8763	0.8144	0.9157	0.8594
	Emboss	0.8640	0.8094	0.8939	0.8328	0.8277	0.7647	0.8803	0.8192	0.9136	0.8570
	Flip	0.8721	0.8173	0.8972	0.8364	0.8457	0.7832	0.8656	0.8016	0.9106	0.8519
	Gaussian Blur	0.8657	0.8112	0.8955	0.8348	0.8231	0.7597	0.8802	0.8188	0.9135	0.8571
	Grid Distortion	0.8782	0.8265	0.9004	0.8405	0.8537	0.7903	0.8757	0.8136	0.9154	0.8589
	Grid Dropout	0.8639	0.8084	0.8924	0.8313	0.8348	0.7719	0.8762	0.8143	0.9120	0.8548
	Image Compression	0.8682	0.8130	0.8935	0.8320	0.8367	0.7734	0.8819	0.8212	0.9150	0.8586
	Median Blur	0.8627	0.8073	0.8936	0.8325	0.8281	0.7637	0.8808	0.8195	0.9151	0.8588
	Optical Distortion	0.8716	0.8175	0.8964	0.8359	0.8385	0.7762	0.8800	0.8188	0.9156	0.8594
	Piecewise Affine	0.8800	0.8286	0.8982	0.8380	0.8538	0.7903	0.8768	0.8146	0.9154	0.8588
	Posterize	0.8642	0.8095	0.8954	0.8339	0.8321	0.7684	0.8777	0.8161	0.9141	0.8571
	RBC	0.8604	0.8044	0.8949	0.8334	0.8329	0.7690	0.8781	0.8163	0.9136	0.8564
	Random Crop	0.8658	0.8098	0.8926	0.8307	0.8312	0.7680	0.8800	0.8190	0.9123	0.8555
	Random Gamma	0.8674	0.8112	0.8923	0.8302	0.8302	0.7667	0.8809	0.8200	0.9138	0.8571
	Random Snow	0.8669	0.8112	0.8937	0.8319	0.8388	0.7751	0.8750	0.8127	0.9131	0.8563
	Rotate	**0.8799**	**0.8259**	0.8997	0.8401	**0.8597**	**0.7969**	0.8679	0.8043	0.9126	0.8548
	Sharpen	0.8641	0.8085	0.8962	0.8349	0.8364	0.7734	**0.8844**	**0.8236**	**0.9160**	**0.8602**
	Shift Scale Rotate	0.8777	0.8253	0.8990	0.8394	0.8471	0.7849	0.8728	0.8098	0.9148	0.8582

Table 7.3: Results of the proposed data augmentation applied in combination with the traditional data augmentation techniques in the unified training set. The images were generated considering the minimum saliency distance between the image generated by the GAN and the lesion image from the dataset. The lesions are placed in a random lung side from the original image from the dataset. The values highlighted in green show the data augmentation techniques in which the P-value achieved values lower than 0.05, and thus the null hypothesis was rejected (i.e., there is a statistical difference and the results achieved are better than without data augmentation). The blue-colored values indicate the best F-score values, and the red-colored values indicate the best IoU values. The underscored values show the techniques in which the proposed augmentation combined with the traditional data augmentation techniques achieved a P-value lower than 0.05 when compared to just applying the generic data augmentation techniques, and the null hypothesis was rejected.

GAN	**Augmentation**	**CC-CCII**		**MedSeg**		**MosMed**		**Ricord1a**		**Zenodo**	
		F-score	IoU	F-score	IoU	F-score	IoU	F-score	IoU	F-score	IoU
	No Augmentation	0.8636	0.8087	0.8881	0.8253	0.8185	0.7547	0.8599	0.7947	0.9096	0.8514
Stargan	CLAHE	0.8573	0.8014	0.8924	0.8302	0.8303	0.7668	0.8793	0.8175	0.9118	0.8543
	Coarse Dropout	0.8689	0.8133	0.8954	0.8344	0.8363	0.7735	0.8793	0.8179	0.9142	0.8576
	Elastic Transform	0.8769	0.8251	**0.9010**	**0.8415**	0.8535	0.7914	0.8754	0.8132	0.9159	0.8596
	Emboss	0.8711	0.8162	0.8949	0.8340	0.8284	0.7647	0.8806	0.8194	0.9150	0.8583
	Flip	0.8717	0.8175	0.8960	0.8351	0.8487	0.7860	0.8681	0.8045	0.9106	0.8523
	Gaussian Blur	0.8645	0.8089	0.8936	0.8331	0.8285	0.7647	0.8800	0.8185	0.9145	0.8584
	Grid Distortion	**0.8781**	**0.8256**	0.8999	0.8399	0.8555	0.7928	0.8769	0.8147	**0.9162**	0.8599
	Grid Dropout	0.8642	0.8080	0.8928	0.8312	0.8311	0.7686	0.8750	0.8128	0.9115	0.8536
	Image Compression	0.8639	0.8084	0.8918	0.8302	0.8283	0.7641	0.8791	0.8177	0.9131	0.8565
	Median Blur	0.8626	0.8072	0.8949	0.8342	0.8286	0.7651	0.8812	0.8200	0.9152	0.8590
	Optical Distortion	0.8748	0.8206	0.8970	0.8365	0.8337	0.7708	0.8792	0.8177	0.9158	0.8597
	Piecewise Affine	0.8767	0.8247	0.9000	0.8401	**0.8600**	**0.7983**	0.8771	0.8151	0.9161	0.8598
	Posterize	0.8623	0.8071	0.8946	0.8331	0.8332	0.7690	0.8771	0.8154	0.9132	0.8564
	RBC	0.8578	0.8023	0.8985	0.8372	0.8387	0.7752	0.8788	0.8167	0.9128	0.8556
	Random Crop	0.8669	0.8110	0.8938	0.8319	0.8336	0.7708	0.8809	0.8199	0.9128	0.8561
	Random Gamma	0.8652	0.8089	0.8930	0.8308	0.8308	0.7672	0.8803	0.8191	0.9130	0.8559
	Random Snow	0.8698	0.8142	0.8933	0.8313	0.8370	0.7745	0.8749	0.8120	0.9137	0.8568
	Rotate	0.8777	0.8248	0.8984	0.8386	0.8578	0.7937	0.8657	0.8017	0.9118	0.8538
	Sharpen	0.8638	0.8088	0.8957	0.8342	0.8298	0.7665	**0.8840**	**0.8227**	0.9160	**0.8600**
	Shift Scale Rotate	0.8771	0.8246	0.8978	0.8385	0.8554	0.7922	0.8734	0.8105	0.9152	0.8585
Stylegan	CLAHE	0.8554	0.7999	0.8910	0.8281	0.8343	0.7704	0.8757	0.8137	0.9121	0.8546
	Coarse Dropout	0.8690	0.8138	0.8959	0.8353	0.8346	0.7714	0.8806	0.8193	0.9136	0.8573
	Elastic Transform	0.8794	0.8278	0.8999	0.8404	0.8496	0.7873	0.8751	0.8126	0.9158	0.8595
	Emboss	0.8654	0.8111	0.8936	0.8323	0.8301	0.7659	0.8793	0.8180	0.9140	0.8570
	Flip	0.8746	0.8206	0.8982	0.8376	0.8466	0.7851	0.8678	0.8043	0.9109	0.8523
	Gaussian Blur	0.8687	0.8141	0.8952	0.8346	0.8280	0.7654	0.8819	0.8209	0.9144	0.8584
	Grid Distortion	0.8783	0.8264	**0.9013**	**0.8414**	0.8582	0.7948	0.8768	0.8147	**0.9167**	**0.8607**
	Grid Dropout	0.8652	0.8092	0.8937	0.8324	0.8382	0.7749	0.8759	0.8134	0.9110	0.8534
	Image Compression	0.8682	0.8134	0.8948	0.8332	0.8344	0.7717	0.8819	0.8209	0.9132	0.8567
	Median Blur	0.8654	0.8105	0.8942	0.8335	0.8293	0.7669	0.8808	0.8196	0.9153	0.8594
	Optical Distortion	0.8722	0.8188	0.8990	0.8390	0.8361	0.7731	0.8807	0.8194	0.9159	0.8599
	Piecewise Affine	0.8779	0.8267	0.8972	0.8372	0.8514	0.7889	0.8750	0.8126	0.9146	0.8582
	Posterize	0.8633	0.8070	0.8952	0.8338	0.8313	0.7674	0.8765	0.8144	0.9130	0.8558
	RBC	0.8597	0.8034	0.8956	0.8342	0.8397	0.7762	0.8785	0.8167	0.9128	0.8559
	Random Crop	0.8650	0.8096	0.8918	0.8298	0.8264	0.7631	0.8794	0.8177	0.9135	0.8565
	Random Gamma	0.8653	0.8098	0.8929	0.8311	0.8280	0.7651	0.8820	0.8206	0.9139	0.8571
	Random Snow	0.8652	0.8090	0.8941	0.8323	0.8415	0.7777	0.8763	0.8137	0.9135	0.8563
	Rotate	0.8786	0.8257	0.8989	0.8389	0.8551	0.7921	0.8673	0.8036	0.9123	0.8545
	Sharpen	0.8651	0.8103	0.8941	0.8330	0.8308	0.7675	**0.8827**	**0.8217**	0.9155	0.8596
	Shift Scale Rotate	**0.8810**	**0.8288**	0.8991	0.8397	**0.8583**	**0.7955**	0.8740	0.8112	0.9154	0.8588