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Large-scale implementation of an Artificial Intelligence software to improve patient experience and enhance productivity in MRI departments

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Introduction

One relevant complaint of patients undergoing an MRI study is the **scan length**.

Apart from worsening the **patient experience**, scan length is also a key factor in **image quality control**, since longer scans are more difficult for the patients to tolerate and thus more prone to motion artifacts.

On top of that, scan length is the most important limiting factor for patients' scheduling and, consequently, the **productivity** of MR departments.

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Purpose

The purpose of this study was to evaluate if the adoption of a proprietary Artificial Intelligence Software that reduces scan time without compromising image quality is correlated with:

- a **decrease in the average scan time** considering all imaging protocols (with and without the software)

- an **increase in the number of possible scheduling slots** for MRI scans than can be offered to patients.

- **fewer patient recalls** for re-imaging due to intolerance or motion artifacts;

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Methods

The implemented software is **fully automatized and compatible** with any MRI suite, operating on the local server **without** outside traffic of patient information. It improves the image's signal-to-noise ratio by correcting the spatial frequency data collected in K space by a proprietary **Deep Learning** model.

The Software was implemented throughout the year 2021 in 18 MRI equipment located in different clinics from four estates in Brazil pertaining to our teleradiology group. Adherence to optimized protocols increased throughout the year in these machines, reaching up to 70% of the imaging protocols by body region in December.

The software performance was evaluated during the whole implementation process to ensure image quality is maintained.

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Methods

We then compared data in the periods before and after the implementation of the software.

The data analyzed were:

- scan length
- patient recall rates
- number of possible slots for patient scheduling

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Results - Scan length

An **average reduction** of 28% in scan length was observed in all imaging protocols in which the software was being used (range 8% to 51%), meaning a reduction from an average of 17 minutes and 15 seconds per scan to 12 minutes and 25 seconds.

Type of Study	Sample		Median Scan Time		Variation (%)
	Pre-implementation	Post-implementation	Pre-implementation	Post-implementation	
Brain	203	48	22m57s	32m26s	41%
Neck	76	5	39m17s	31m16s	-20%
C-Spine	4.017	3.958	14m33s	12m27s	-14%
T-Spine	1.222	1.216	23m12s	17m41s	-24%
L-Spine	8.675	7.326	14m46s	11m54s	-19%
Shoulder	4.234	4.311	15m10s	12m59s	-14%
Wrist	624	649	21m11s	16m00s	-24%
Hand	546	448	25m34s	17m55s	-30%
Pelvis	8	4	33m32s	16m26s	-51%
Hip joint	1.443	1.6661	21m36s	18m02s	-16%
Thigh	254	95	31m48s	24m52s	-22%
Knee	10.293	10.167	14m37s	08m46s	-40%
Calf	312	121	28m41s	21m50s	-24%
Ankle	1.996	1.420	18m23s	15m04s	-18%
Foot	1.329	1.382	18m22s	14m54s	-19%
Total	37.612	33.261	17m15s	12m25s	-28%

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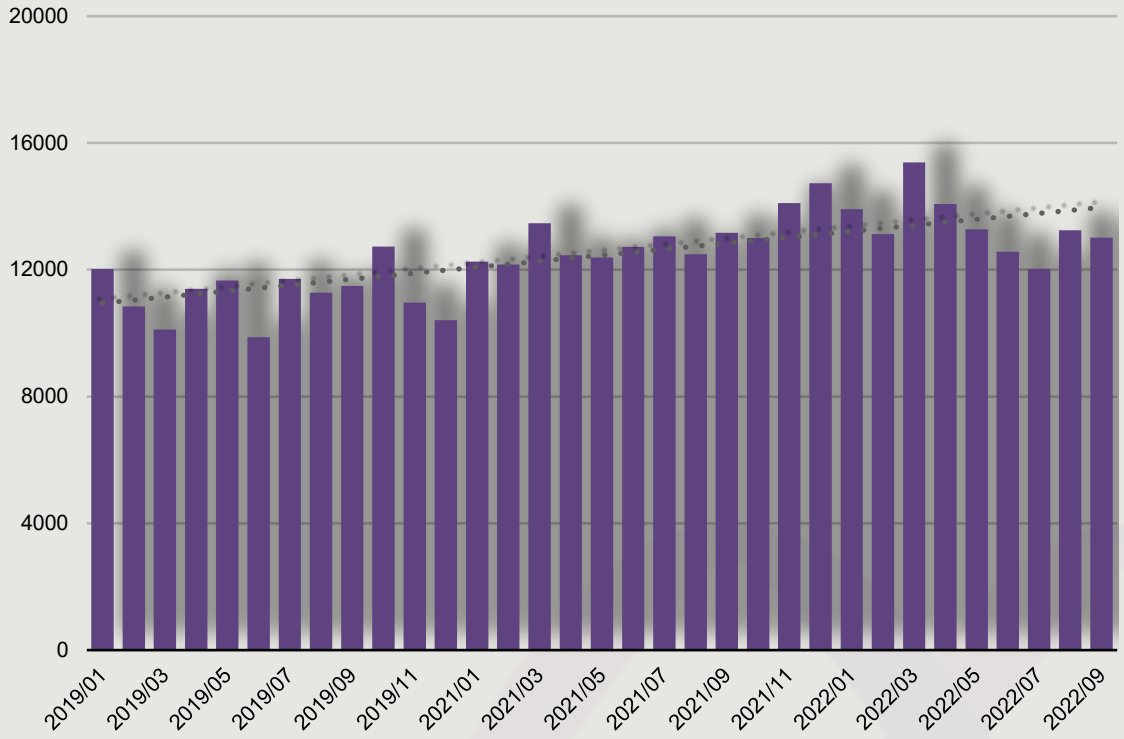
Results - Patient scheduling

In addition to scan length reduction, we were able to offer **more slots** for patient scheduling, going from an average of 374 available machine/hours per month before software installation to 440 machine/hours per month after its installation (an **increase** of 18%).



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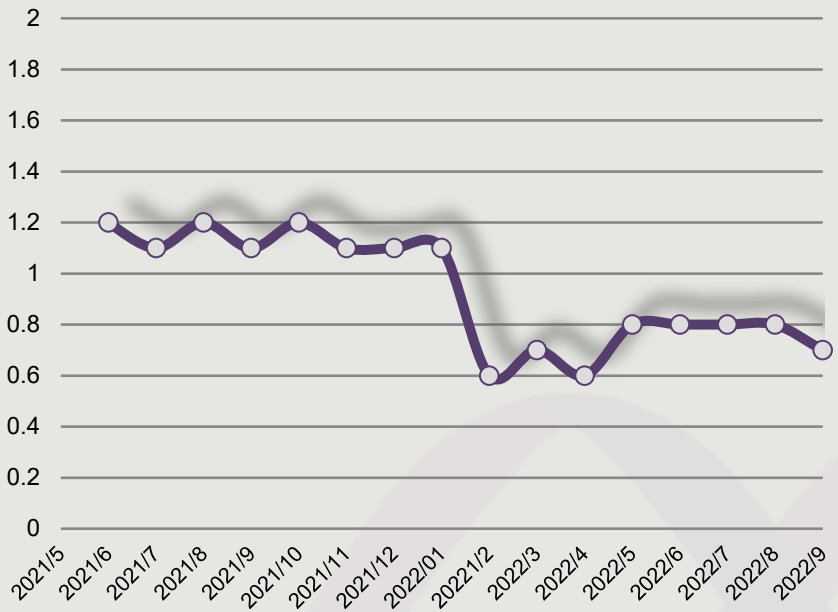
Results - Patient recall rates

In 2021, we performed a total of 724.476 MRI studies (an average of 60.373 studies per month). On average, 1,1% of patients (667) were **recalled** each month due to various reasons, but mainly to administer intravenous contrast, finish an exam that the patient could not tolerate staying inside the machine, or repeat sequences that were spoiled by motion artifacts. After the AI software implementation, the number of recalled patients **dropped** by around 20%, to an average of 0,9%(260).



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Limitations

This analysis was based on a purely operational angle, regarding how improvements in MRI techniques can lead to better patient experience and enhanced productivity.

Patient satisfaction or increases in the total number of patients scanned per month, among other metrics, depend not only on these improvements in protocols but also on a myriad of factors such as confirmation calls, bureaucratic processes, the season of the year, etc.

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Conclusion

The large-scale implementation of Artificial Intelligence Software in our Radiology group was correlated with **measurable improvements** in patient care and in machine productivity. More importantly, this was achieved while **maintaining the quality** of the acquired MRI images.