

# Basic requirements for AI services in radiology



№	Type of exam	Clinical task solved by AI service	Preliminary phase (retrospective study) – features of the calibration dataset	Main phase (prospective study) – findings for which positive and negative responses of AI service are expected	AI service response	AI service response format	AI service response file
1	Chest X-ray or fluorography	Detection and localization of radiological findings ( <b>at least one</b> ), consistent with <b>at least one</b> of the following diseases (from the list below): <ol style="list-style-type: none"> <li>1. Tuberculosis (A15–A16, A19);</li> <li>2. Pneumonia, suppurative and necrotic conditions (J10–J18, J80–J86);</li> <li>3. Hydrothorax (J94, R09.1);</li> <li>4. Pneumothorax (S27.0);</li> <li>5. Atelectasis (J98.1);</li> <li>6. Tumors (D38.1–D38.4, C34–C39);</li> <li>7. Fracture of rib(s), sternum and thoracic spine (S22)</li> </ol>	<p><b>Abnormalities are present:</b></p> <p><b>A.</b> Presence of at least one radiological finding* from the list below:</p> <ol style="list-style-type: none"> <li>1. Pleural effusion</li> <li>2. Pneumothorax (S27.0)</li> <li>3. Atelectasis</li> <li>4. Shadow</li> <li>5. Infiltration/consolidation</li> <li>6. Dissemination (&gt;20 focal abnormalities)</li> <li>7. Cavity with decay</li> <li>8. Cavity with fluid level</li> <li>9. Pulmonary calcification</li> <li>10. Cortical breach</li> </ol> <p><b>B.</b> Positive verification results of at least one of the prioritized diseases</p>	<p><b>Abnormalities are not discovered:</b> none of radiological findings from the A-list.</p>	<p><b>Mandatory</b> – probability of presence at least one of the radiological findings in the entire study from the A-list</p> <p><b>Mandatory</b> – localization of the discovered findings (if applicable)</p> <p><b>Optional</b> – name of one or more radiological findings</p>	<p>Fractional or integer number</p> <p>Heatmap/ contour/ mask/etc.</p> <p>Text</p>	<p>Apache Kafka Message + DICOM</p> <p>DICOM</p> <p>DICOM</p>

\* Radiological signs are not pathognomonic for a single disease, except pneumothorax. A description of significant features is provided on the next page.

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Radiological finding	Clinically significant radiological features
1. Pleural effusion	Homogeneous increased density in lower lung lobes with almost horizontal edge, the anatomical structure of the outer-lower areas of lungs - the costodiaphragmatic sinus - is not visible.
2. Pneumothorax (S27.0)	Homogeneous enlightenment in the peripheral areas of the upper lung lobes, corresponding to the air distribution in the enclosed space, lung markings in the interest zone is not visualized (shifted).
3. Atelectasis	Volume loss due to the lung collapse. Subsegmental, segmental, lobar, total. Homogeneous increased density of the lung unit with shifting of anatomical structures towards the collapse on top of the volume loss.
4. Shadow	Focal area of increased density of the lung tissue with abnormal differentiation of lung markings not corresponding to the anatomical peribronchial distribution; a significant variation in localization/size/contours/shape is possible.
5. Infiltration/consolidation	Focal area of increased density of the lung tissue with complete/ incomplete abnormal differentiation of lung markings corresponding to the anatomical peribronchial/segmental/lobular distribution.
6. Dissemination	Multiple similar subsantimeter focal zones of increased density of the lung tissue corresponding to the anatomical peribronchial distribution.
7. Cavity with decay	Focal zone of increased density of the lung tissue with abnormal differentiation of lung markings and central enlightenment not corresponding to the anatomical peribronchial distribution; a significant variation in localization/size/contours/shape is possible.
8. Cavity with fluid level	Focal zone of increased density of the lung tissue with abnormal differentiation of lung markings and a horizontal gas/fluid boundary not corresponding to the anatomical peribronchial distribution; a significant variation in localization/size/contours/shape is possible.
9. Pulmonary calcification	Focal homogeneous high-intensity (high-density) spot with clear contours.
10. Cortical breach	Interruption of the external contour of the bone, possibly with displacement/divergence of bone fragments.

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2	Chest computed tomography/ Chest low-dose computed tomography for lung cancer screening	Detection of CT findings consistent with lung cancer (C34)	<b>Abnormalities are present:</b>		<b>Mandatory</b> – probability of presence of lung cancer signs in the entire study (C34): the list A	Fractional or integer number	Apache Kafka Message + DICOM
			A. At least one solid or subsolid nodule with a volume >100 mm <sup>3</sup>				
			B. Results of pathomorphological testing: malignant neoplasm		<b>Mandatory</b> – localization of the discovered findings	Heatmap/ contour/mask/etc.	DICOM
			<b>Abnormalities are not discovered:</b> none of the findings that matches specified conditions		<b>Optional</b> – scrolling indicating a current slice and slices with pathological findings	-	DICOM
				<b>Optional</b> – probability of the malignancy for each detected findings (C34)	Fractional or integer number	DICOM	

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3	Diagnostic/ screening mammography	Detection and localization of findings consistent with breast cancer (C50)	<b>Abnormalities are present:</b> A. BI-RADS 3–5 / 0*		<b>Mandatory</b> – probability of presence of breast cancer signs in the entire study (C50):the list A	Fractional or integer number	Apache Kafka Message + DICOM
			B. Results of pathomorphological testing: malignant neoplasm		<b>Mandatory</b> – localization of findings in the entire study indicating breast cancer (C50): the list A	Heatmap/ contour/ mask/ etc.	DICOM
			<b>Abnormalities are not discovered:</b> B. BI-RADS 1–2		<b>Optional</b> – the most likely category for each finding from the list below and probability in percentage belonging to that category: <ul style="list-style-type: none"> <li>• malignant neoplasm</li> <li>• benign tumor</li> <li>• suspicious calcification</li> <li>• atypical lymph nodes</li> <li>• skin thickening</li> </ul>	Fractional or integer number/ text/etc.	DICOM

\*BI-RADS for breast cancer screening

# Basic requirements for AI services (COVID-19)



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4	Chest X-ray or fluorography	Detection and localization of radiological findings consistent with coronavirus infection (COVID-19)	<b>Abnormalities are present:</b>		<b>Mandatory</b> - triage of studies in the worklist (based on absence or presence of findings from the A list); OR <b>Mandatory</b> - probability of findings in the entire study from the A-list	Fractional or integer number	Apache Kafka Message + DICOM
			<b>A.</b> Bilateral infiltration (opacity) of pulmonary tissue predominantly peripheral and basal areas				
			<b>B.</b> Positive results of validation of viral pneumonia by chest CT scan and coronavirus infection (COVID-19) by RT-PCR		<b>Mandatory</b> - localization of the discovered findings (if applicable)	Heatmap/contour/mask/etc.	DICOM
			<b>Abnormalities are not discovered:</b> absence of radiological findings from the A-list				

# Basic requirements for AI services (COVID-19)



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5	Chest CT scan	Detection of CT findings consistent with coronavirus infection (COVID-19)	<b>Abnormalities are present:</b>		<b>Mandatory</b> – triage of studies in the worklist (based on absence or presence of at least one of the findings from the A-list); OR <b>Mandatory</b> – probability of presence at least one of the findings in the entire study from the A-list	Fractional or integer number	Apache Kafka Message + DICOM
			<b>A.</b> 1. Bilateral ground glass opacities of pulmonary tissue, mainly peripheral distribution with or without consolidations and air bronchogram 2. Bilateral pulmonary infiltration like "cobblestone pavement" (thickening of interlobular septa interstitium against ground glass opacities), mainly peripheral distribution with or without consolidations and air bronchogram				
			<b>B.</b> Positive results of validation of coronavirus infection (COVID-19) by RT-PCR		<b>Mandatory</b> – localization of the discovered findings	Heatmap/contour/mask/etc.	DICOM
			<b>Abnormalities are not discovered:</b> none of radiological findings from the A-list		<b>Optional</b> – scrolling indicating a current slice and slices with pathological findings	-	DICOM
					<b>Optional</b> – classification of the lung tissue abnormalities (CT 0-4) based on pulmonary parenchymal involvement	Text	DICOM