WEBVTT

NOTE duration: ”00:21:20.597”

NOTE Confidence: 0.92878723

00:00:00.080 --> 00:00:01.280 Okay. So we're gonna switch

NOTE Confidence: 0.92878723

00:00:01.280 --> 00:00:02.399 gears and talk about image

NOTE Confidence: 0.92878723

00:00:02.399 --> 00:00:03.860 analysis and AI. And, incidentally,

NOTE Confidence: 0.92878723

00:00:03.919 --> 00:00:04.640 if you sign up, you're

NOTE Confidence: 0.92878723

00:00:04.640 --> 00:00:06.000 gonna get information about the

NOTE Confidence: 0.92878723

00:00:06.000 --> 00:00:06.879 AI interest group in the

NOTE Confidence: 0.92878723

00:00:06.879 --> 00:00:07.379 institute.

NOTE Confidence: 0.907092

00:00:07.839 --> 00:00:08.960 We'll do some office hours

NOTE Confidence: 0.907092

00:00:08.960 --> 00:00:10.320 and some training seminars for

NOTE Confidence: 0.907092

00:00:10.320 --> 00:00:11.119 that. So we have three

NOTE Confidence: 0.907092

00:00:11.119 --> 00:00:13.039 speakers. Doctor. Guarim is first,

NOTE Confidence: 0.907092

00:00:13.039 --> 00:00:14.559 who's an assistant professor from

NOTE Confidence: 0.907092

00:00:14.559 --> 00:00:15.059 France,

NOTE Confidence: 0.95883995

00:00:15.485 --> 00:00:17.005 moved to Yale recently, and

NOTE Confidence: 0.95883995

00:00:17.005 --> 00:00:17.965 he works in both pet

NOTE Confidence: 0.95883995

00:00:17.965 --> 00:00:18.465 reconstruction

NOTE Confidence: 0.870453

00:00:18.845 --> 00:00:20.864 and algorithms for head

NOTE Confidence: 0.83954364

00:00:21.485 --> 00:00:22.605 imaging. And then we also

NOTE Confidence: 0.83954364

00:00:22.605 --> 00:00:24.525 have doctor John Onofrey, who's

NOTE Confidence: 0.83954364

00:00:24.525 --> 00:00:25.985 also in some processing radiology

NOTE Confidence: 0.8230873

00:00:27.244 --> 00:00:28.765 and joined with urology, and

NOTE Confidence: 0.8230873

00:00:28.765 --> 00:00:30.540 he works in variety of

NOTE Confidence: 0.8230873

00:00:30.700 --> 00:00:32.700 outcome development, particularly prostate cancer,

NOTE Confidence: 0.8230873

00:00:32.700 --> 00:00:34.380 and then doctor Nizhevornick who's

NOTE Confidence: 0.8230873

00:00:34.380 --> 00:00:35.840 medicine for some radiology.

NOTE Confidence: 0.97027594

00:00:37.100 --> 00:00:38.460 And they both have the

NOTE Confidence: 0.97027594

00:00:38.460 --> 00:00:40.400 Hopkins Yale kind of pipeline

NOTE Confidence: 0.97027594

00:00:40.620 --> 00:00:41.520 here, and

NOTE Confidence: 0.90708435

00:00:41.979 --> 00:00:43.180 work is also in outcome

NOTE Confidence: 0.90708435

00:00:43.180 --> 00:00:44.400 development and also

NOTE Confidence: 0.9449562

00:00:44.875 --> 00:00:46.475 brain diseases and more recently

NOTE Confidence: 0.9449562

00:00:46.475 --> 00:00:48.175 in some of the predicting,

NOTE Confidence: 0.87408113

00:00:49.515 --> 00:00:50.815 birth issues with,

NOTE Confidence: 0.96093506

00:00:51.675 --> 00:00:52.875 accreta. I will not try

NOTE Confidence: 0.96093506

00:00:52.875 --> 00:00:53.995 to name that. So with

NOTE Confidence: 0.96093506

00:00:53.995 --> 00:00:54.495 that,

NOTE Confidence: 0.91776663

00:01:01.239 --> 00:01:02.460 Thank you for the introduction.

NOTE Confidence: 0.91776663

00:01:02.519 --> 00:01:03.559 My name is Thibaut Marine.

NOTE Confidence: 0.91776663

00:01:03.559 --> 00:01:04.759 I'm an assistant professor in

NOTE Confidence: 0.91776663

00:01:04.759 --> 00:01:06.040 the department of radiology and

NOTE Confidence: 0.91776663

00:01:06.040 --> 00:01:07.640 biomedical imaging with a secondary

NOTE Confidence: 0.91776663

00:01:07.640 --> 00:01:09.095 appointment in BITS, and I'm

NOTE Confidence: 0.91776663

00:01:09.095 --> 00:01:10.935 with the Yale Biomedical Imaging

NOTE Confidence: 0.91776663

00:01:10.935 --> 00:01:12.375 Institute. Today, I'm gonna talk

NOTE Confidence: 0.91776663

00:01:12.375 --> 00:01:14.455 about data science infrastructure for

NOTE Confidence: 0.91776663

00:01:14.455 --> 00:01:16.075 it and some example of

NOTE Confidence: 0.91776663

00:01:16.215 --> 00:01:17.575 processing pipelines that we have

NOTE Confidence: 0.91776663

00:01:17.575 --> 00:01:18.075 established.

NOTE Confidence: 0.975604

00:01:18.615 --> 00:01:20.375 So, as we've seen through

NOTE Confidence: 0.975604

00:01:20.375 --> 00:01:21.415 the description of the calls

NOTE Confidence: 0.975604

00:01:21.415 --> 00:01:23.090 and the imaging modalities available

NOTE Confidence: 0.975604

00:01:23.090 --> 00:01:24.130 at Yale, we are in

NOTE Confidence: 0.975604

00:01:24.130 --> 00:01:25.810 a unique position to use

NOTE Confidence: 0.975604

00:01:25.810 --> 00:01:26.689 data from a lot of

NOTE Confidence: 0.975604

00:01:26.689 --> 00:01:28.549 modalities, different research groups.

NOTE Confidence: 0.9600195

00:01:28.850 --> 00:01:29.649 What we are trying to

NOTE Confidence: 0.9600195

00:01:29.649 --> 00:01:31.009 build is bridges so that

NOTE Confidence: 0.9600195

00:01:31.009 --> 00:01:33.009 that can become cross modality

NOTE Confidence: 0.9600195

00:01:33.009 --> 00:01:34.289 and across group. We have

NOTE Confidence: 0.9600195

00:01:34.289 --> 00:01:35.490 data from PET, from MR,

NOTE Confidence: 0.9600195

00:01:35.490 --> 00:01:36.530 from the research calls. We

NOTE Confidence: 0.9600195

00:01:36.530 --> 00:01:37.490 also have data from the

NOTE Confidence: 0.9600195

00:01:37.490 --> 00:01:37.990 hospital.

NOTE Confidence: 0.9318803

00:01:38.605 --> 00:01:39.725 It's across the street, but

NOTE Confidence: 0.9318803

00:01:39.725 --> 00:01:40.765 that data is more difficult

NOTE Confidence: 0.9318803

00:01:40.765 --> 00:01:42.525 to access because of safety

NOTE Confidence: 0.9318803

00:01:42.525 --> 00:01:44.605 concerns and privacy concerns. So

NOTE Confidence: 0.9318803

00:01:44.605 --> 00:01:45.805 what we are trying to

NOTE Confidence: 0.9318803

00:01:45.805 --> 00:01:48.305 establish is a centralized repository

NOTE Confidence: 0.9318803

00:01:48.525 --> 00:01:49.825 for data first.

NOTE Confidence: 0.9804371

00:01:50.445 --> 00:01:52.200 In that central repository, data

NOTE Confidence: 0.9804371

00:01:52.200 --> 00:01:53.000 from the calls will be

NOTE Confidence: 0.9804371

00:01:53.000 --> 00:01:54.440 collected. Data from the hospital

NOTE Confidence: 0.9804371

00:01:54.440 --> 00:01:55.240 will also have a a

NOTE Confidence: 0.9804371

00:01:55.240 --> 00:01:56.920 bridge that is, allowing us

NOTE Confidence: 0.9804371

00:01:56.920 --> 00:01:58.200 to get that data in

NOTE Confidence: 0.9804371

00:01:58.200 --> 00:01:59.400 a secure way and host

NOTE Confidence: 0.9804371

00:01:59.400 --> 00:02:00.600 it on servers where they

NOTE Confidence: 0.9804371

00:02:00.600 --> 00:02:01.820 can be hosted safely

NOTE Confidence: 0.953019

00:02:02.280 --> 00:02:02.760 without,

NOTE Confidence: 0.9988288

00:02:03.240 --> 00:02:04.380 identification information.

NOTE Confidence: 0.92456675

00:02:05.065 --> 00:02:06.685 Along with that, data repository,

NOTE Confidence: 0.92456675

00:02:06.825 --> 00:02:07.545 we need it to be

NOTE Confidence: 0.92456675

00:02:07.545 --> 00:02:08.584 searchable. So we need a

NOTE Confidence: 0.92456675

00:02:08.584 --> 00:02:10.665 database and, an index, and

NOTE Confidence: 0.92456675

00:02:10.665 --> 00:02:12.665 we need computing, power because

NOTE Confidence: 0.92456675

00:02:12.665 --> 00:02:14.584 all the processing pipeline pipelines

NOTE Confidence: 0.92456675

00:02:14.584 --> 00:02:16.025 we've looked at through the,

NOTE Confidence: 0.92456675

00:02:16.264 --> 00:02:17.325 prism of applications,

NOTE Confidence: 0.9420737

00:02:17.870 --> 00:02:19.629 they require data processing and

NOTE Confidence: 0.9420737

00:02:19.629 --> 00:02:20.769 so they require resources.

NOTE Confidence: 0.9767113

00:02:21.389 --> 00:02:23.010 To this end, we're renovating,

NOTE Confidence: 0.97495216

00:02:23.469 --> 00:02:24.590 rooms in the,

NOTE Confidence: 0.912789

00:02:24.909 --> 00:02:26.370 one hundred Church Street,

NOTE Confidence: 0.64292574

00:02:27.629 --> 00:02:28.129 building

NOTE Confidence: 0.9739855

00:02:28.590 --> 00:02:30.435 to host those servers. So

NOTE Confidence: 0.9739855

00:02:30.435 --> 00:02:31.395 this has been a long

NOTE Confidence: 0.9739855

00:02:31.395 --> 00:02:31.895 process,

NOTE Confidence: 0.9823352

00:02:32.195 --> 00:02:33.155 but over the last few

NOTE Confidence: 0.9823352

00:02:33.155 --> 00:02:34.675 months, the room has, gotten

NOTE Confidence: 0.9823352

00:02:34.675 --> 00:02:35.795 ready, and we now have

NOTE Confidence: 0.9823352

00:02:35.795 --> 00:02:36.675 a picture of the room

NOTE Confidence: 0.9823352

00:02:36.675 --> 00:02:37.895 that is ready for use.

NOTE Confidence: 0.9631611

00:02:38.195 --> 00:02:39.635 This room will host a

NOTE Confidence: 0.9631611

00:02:39.635 --> 00:02:40.435 combination of,

NOTE Confidence: 0.9969811

00:02:41.075 --> 00:02:42.855 computing power and hosting

NOTE Confidence: 0.9602135

00:02:43.235 --> 00:02:44.295 for data storage.

NOTE Confidence: 0.963149

00:02:44.620 --> 00:02:46.700 And so CPUs, GPUs that

NOTE Confidence: 0.963149

00:02:46.700 --> 00:02:47.900 are able to work with

NOTE Confidence: 0.963149

00:02:47.900 --> 00:02:49.020 the large amount of data

NOTE Confidence: 0.963149

00:02:49.020 --> 00:02:50.780 we're dealing with. Imaging is

NOTE Confidence: 0.963149

00:02:50.780 --> 00:02:52.139 pretty large compared to other

NOTE Confidence: 0.963149

00:02:52.139 --> 00:02:53.580 data processing pipelines, so we

NOTE Confidence: 0.963149

00:02:53.580 --> 00:02:55.040 need sufficient storage

NOTE Confidence: 0.982511

00:02:55.340 --> 00:02:57.280 along with sufficient computing power.

NOTE Confidence: 0.982511

00:02:57.420 --> 00:02:58.300 And so that's what we

NOTE Confidence: 0.982511

00:02:58.300 --> 00:02:59.520 are working to build.

NOTE Confidence: 0.9472332

00:03:00.355 --> 00:03:01.875 The data that comes from

NOTE Confidence: 0.9472332

00:03:01.875 --> 00:03:03.655 the hospital comes de identified.

NOTE Confidence: 0.9472332

00:03:03.794 --> 00:03:05.235 So in parallel, led by

NOTE Confidence: 0.9472332

00:03:05.235 --> 00:03:06.754 Zinnios, we're looking at a

NOTE Confidence: 0.9472332

00:03:06.754 --> 00:03:07.875 pipeline where we can get

NOTE Confidence: 0.9472332

00:03:07.875 --> 00:03:09.635 data from the hospital de

NOTE Confidence: 0.9472332

00:03:09.635 --> 00:03:10.135 identified.

NOTE Confidence: 0.99583596

00:03:10.514 --> 00:03:11.555 So we have this tool

NOTE Confidence: 0.99583596

00:03:11.555 --> 00:03:13.095 that comes from, from Duke

NOTE Confidence: 0.9468727

00:03:13.410 --> 00:03:15.330 that, is the identification tool

NOTE Confidence: 0.9468727

00:03:15.330 --> 00:03:15.990 that removes

NOTE Confidence: 0.9560596

00:03:16.370 --> 00:03:18.050 all the HIPAA data and,

NOTE Confidence: 0.9560596

00:03:18.370 --> 00:03:20.050 has expert determination, which means

NOTE Confidence: 0.9560596

00:03:20.050 --> 00:03:21.250 that the data can be,

NOTE Confidence: 0.98060626

00:03:21.650 --> 00:03:23.330 transferred to us. Our servers

NOTE Confidence: 0.98060626

00:03:23.330 --> 00:03:23.830 also,

NOTE Confidence: 0.9479171

00:03:24.290 --> 00:03:26.150 comply to the safest procedures

NOTE Confidence: 0.9479171

00:03:26.209 --> 00:03:27.810 and, guidelines for hosting,

NOTE Confidence: 0.98281026

00:03:28.385 --> 00:03:29.924 patient data and subject data.

NOTE Confidence: 0.98281026

00:03:30.144 --> 00:03:31.424 And we are building that

NOTE Confidence: 0.98281026

00:03:31.424 --> 00:03:32.625 framework so this data can

NOTE Confidence: 0.98281026

00:03:32.625 --> 00:03:33.905 be combined with the processing

NOTE Confidence: 0.98281026

00:03:33.905 --> 00:03:35.424 units that we have so

NOTE Confidence: 0.98281026

00:03:35.424 --> 00:03:36.944 that we can make great

NOTE Confidence: 0.98281026

00:03:36.944 --> 00:03:38.704 science together and not have,

NOTE Confidence: 0.98281026

00:03:39.185 --> 00:03:40.704 red tape along the way,

NOTE Confidence: 0.98281026

00:03:40.704 --> 00:03:41.905 but still having the safety

NOTE Confidence: 0.98281026

00:03:41.905 --> 00:03:43.080 of the data. So once

NOTE Confidence: 0.98281026

00:03:43.080 --> 00:03:44.040 we collect the data, we

NOTE Confidence: 0.98281026

00:03:44.040 --> 00:03:45.100 need to make it accessible

NOTE Confidence: 0.98281026

00:03:45.160 --> 00:03:46.680 and searchable. And to this

NOTE Confidence: 0.98281026

00:03:46.680 --> 00:03:47.960 end, we are building a

NOTE Confidence: 0.98281026

00:03:47.960 --> 00:03:49.880 cross modality database that will

NOTE Confidence: 0.98281026

00:03:49.880 --> 00:03:51.320 list all the existing data

NOTE Confidence: 0.98281026

00:03:51.320 --> 00:03:52.380 set that we have,

NOTE Confidence: 0.96280503

00:03:52.760 --> 00:03:54.460 from the different imaging calls.

NOTE Confidence: 0.96280503

00:03:54.615 --> 00:03:55.895 So that people can look

NOTE Confidence: 0.96280503

00:03:55.895 --> 00:03:57.175 and search data that can

NOTE Confidence: 0.96280503

00:03:57.175 --> 00:03:58.295 be useful for their research,

NOTE Confidence: 0.96280503

00:03:58.295 --> 00:03:59.035 for comparisons.

NOTE Confidence: 0.87601054

00:03:59.335 --> 00:04:00.475 Or as George mentioned,

NOTE Confidence: 0.93087536

00:04:00.935 --> 00:04:02.295 when building a new study,

NOTE Confidence: 0.93087536

00:04:02.295 --> 00:04:03.895 maybe very valuable to realize

NOTE Confidence: 0.93087536

00:04:03.895 --> 00:04:05.015 that the control group is

NOTE Confidence: 0.93087536

00:04:05.015 --> 00:04:06.295 already available that can save

NOTE Confidence: 0.93087536

00:04:06.295 --> 00:04:07.770 imaging cost quite a bit.

NOTE Confidence: 0.93087536

00:04:08.010 --> 00:04:09.530 On the table here is

NOTE Confidence: 0.93087536

00:04:09.530 --> 00:04:11.450 shown the list of, PET

NOTE Confidence: 0.93087536

00:04:11.450 --> 00:04:12.810 scans that we've had and

NOTE Confidence: 0.93087536

00:04:12.810 --> 00:04:14.030 sorted by traces.

NOTE Confidence: 0.9775266

00:04:14.650 --> 00:04:15.530 On the PET side, we

NOTE Confidence: 0.9775266

00:04:15.530 --> 00:04:16.890 already have a great database

NOTE Confidence: 0.9775266

00:04:16.890 --> 00:04:17.930 that collects all of this

NOTE Confidence: 0.9775266

00:04:17.930 --> 00:04:19.210 since two thousand five with

NOTE Confidence: 0.9775266

00:04:19.210 --> 00:04:20.670 more than twenty thousand scans.

NOTE Confidence: 0.96391726

00:04:21.014 --> 00:04:21.755 We are building,

NOTE Confidence: 0.9243818

00:04:22.134 --> 00:04:23.735 something that will include MR

NOTE Confidence: 0.9243818

00:04:23.735 --> 00:04:24.695 and PET and be able

NOTE Confidence: 0.9243818

00:04:24.695 --> 00:04:25.755 to be cross searched.

NOTE Confidence: 0.9088409

00:04:27.654 --> 00:04:28.955 Moving away from,

NOTE Confidence: 0.9664955

00:04:30.455 --> 00:04:32.714 data infrastructure to data processing,

NOTE Confidence: 0.9555549

00:04:33.510 --> 00:04:34.710 I wanna talk about a

NOTE Confidence: 0.9555549

00:04:34.710 --> 00:04:36.070 couple of projects we're working

NOTE Confidence: 0.9555549

00:04:36.070 --> 00:04:37.270 in that end, and they

NOTE Confidence: 0.9555549

00:04:37.270 --> 00:04:38.970 are both related to cancer

NOTE Confidence: 0.9555549

00:04:39.029 --> 00:04:40.790 and treatment planning. So the

NOTE Confidence: 0.9555549

00:04:40.790 --> 00:04:41.669 first one is,

NOTE Confidence: 0.99620473

00:04:42.150 --> 00:04:43.669 we're trying to develop methods

NOTE Confidence: 0.99620473

00:04:43.669 --> 00:04:45.669 that can assist radiologists and

NOTE Confidence: 0.99620473

00:04:45.669 --> 00:04:47.830 radiation oncologists for sarcomas and

NOTE Confidence: 0.99620473

00:04:47.830 --> 00:04:49.214 head and neck tumors. The

NOTE Confidence: 0.99620473

00:04:49.214 --> 00:04:49.714 process

NOTE Confidence: 0.9278383

00:04:50.335 --> 00:04:52.355 typically, is after imaging,

NOTE Confidence: 0.9774191

00:04:53.295 --> 00:04:54.654 doing some contouring of the

NOTE Confidence: 0.9774191

00:04:54.654 --> 00:04:56.275 gross tumor volume, the GTV,

NOTE Confidence: 0.9774191

00:04:56.415 --> 00:04:58.335 followed by the clinical target

NOTE Confidence: 0.9774191

00:04:58.335 --> 00:04:59.775 volume, which will be what

NOTE Confidence: 0.9774191

00:04:59.775 --> 00:05:01.315 the radiation will target.

NOTE Confidence: 0.97970355

00:05:01.810 --> 00:05:02.690 And so we're trying to

NOTE Confidence: 0.97970355

00:05:02.690 --> 00:05:04.050 build a pipeline where we

NOTE Confidence: 0.97970355

00:05:04.050 --> 00:05:05.570 have AI all along the

NOTE Confidence: 0.97970355

00:05:05.570 --> 00:05:07.009 way. We have basically two

NOTE Confidence: 0.97970355

00:05:07.009 --> 00:05:08.050 goals. The first one is

NOTE Confidence: 0.97970355

00:05:08.050 --> 00:05:09.089 end to end pipeline where

NOTE Confidence: 0.97970355

00:05:09.089 --> 00:05:10.449 AI can assist radiologists and

NOTE Confidence: 0.97970355

00:05:10.449 --> 00:05:11.430 radiation oncologists.

NOTE Confidence: 0.9945587

00:05:11.810 --> 00:05:13.089 And the second goal is

NOTE Confidence: 0.9945587

00:05:13.089 --> 00:05:15.009 to incorporate variability in the

NOTE Confidence: 0.9945587

00:05:15.009 --> 00:05:15.509 models.

NOTE Confidence: 0.9712634

00:05:15.935 --> 00:05:17.134 One danger of AI is

NOTE Confidence: 0.9712634

00:05:17.134 --> 00:05:18.175 when it gives an answer

NOTE Confidence: 0.9712634

00:05:18.175 --> 00:05:19.214 and we trust this without

NOTE Confidence: 0.9712634

00:05:19.214 --> 00:05:20.574 questioning it. We're trying to

NOTE Confidence: 0.9712634

00:05:20.574 --> 00:05:22.495 develop models that will have,

NOTE Confidence: 0.9712634

00:05:22.895 --> 00:05:24.014 an idea of the confidence

NOTE Confidence: 0.9712634

00:05:24.014 --> 00:05:24.895 they are providing in the

NOTE Confidence: 0.9712634

00:05:24.895 --> 00:05:26.735 images they are giving us.

NOTE Confidence: 0.9712634

00:05:26.735 --> 00:05:28.255 This way, the human is

NOTE Confidence: 0.9712634

00:05:28.255 --> 00:05:29.400 always in the loop and

NOTE Confidence: 0.9712634

00:05:29.400 --> 00:05:30.839 we can have a better

NOTE Confidence: 0.9712634

00:05:30.839 --> 00:05:31.339 targeted

NOTE Confidence: 0.96478164

00:05:31.800 --> 00:05:33.180 analysis from the humans.

NOTE Confidence: 0.9938223

00:05:33.720 --> 00:05:35.080 That variability is something we

NOTE Confidence: 0.9938223

00:05:35.080 --> 00:05:35.820 have quantified,

NOTE Confidence: 0.9548703

00:05:36.520 --> 00:05:38.200 inter and intra reader for

NOTE Confidence: 0.9548703

00:05:38.200 --> 00:05:39.880 soft tissue sarcomas, and we

NOTE Confidence: 0.9548703

00:05:39.880 --> 00:05:41.480 observe that there is always

NOTE Confidence: 0.9548703

00:05:41.480 --> 00:05:42.760 an amount of variability that

NOTE Confidence: 0.9548703

00:05:42.760 --> 00:05:44.540 is, that is present there

NOTE Confidence: 0.9755361

00:05:44.845 --> 00:05:46.445 within readers and across readers.

NOTE Confidence: 0.9755361

00:05:46.445 --> 00:05:47.645 So we quantified this, and

NOTE Confidence: 0.9755361

00:05:47.645 --> 00:05:49.565 we developed methods that allow

NOTE Confidence: 0.9755361

00:05:49.565 --> 00:05:50.845 us to utilize this in

NOTE Confidence: 0.9755361

00:05:50.845 --> 00:05:52.125 the model rather than fight

NOTE Confidence: 0.9755361

00:05:52.125 --> 00:05:53.805 it, basically. It's actually valuable

NOTE Confidence: 0.9755361

00:05:53.805 --> 00:05:55.885 information. The key observation is

NOTE Confidence: 0.9755361

00:05:55.885 --> 00:05:56.385 that,

NOTE Confidence: 0.9762423

00:05:57.260 --> 00:05:59.600 variability across readers is indication

NOTE Confidence: 0.9762423

00:05:59.660 --> 00:06:01.100 of confidence. When people are

NOTE Confidence: 0.9762423

00:06:01.100 --> 00:06:02.300 confident, the variability will be

NOTE Confidence: 0.9762423

00:06:02.300 --> 00:06:03.420 lower, and that can be

NOTE Confidence: 0.9762423

00:06:03.420 --> 00:06:05.180 very valuable information. If we

NOTE Confidence: 0.9762423

00:06:05.180 --> 00:06:08.000 can provide segmentations to readers

NOTE Confidence: 0.98632115

00:06:08.300 --> 00:06:09.660 that have that notion of

NOTE Confidence: 0.98632115

00:06:09.660 --> 00:06:10.860 confidence, they can spend the

NOTE Confidence: 0.98632115

00:06:10.860 --> 00:06:11.580 time on the part of

NOTE Confidence: 0.98632115

00:06:11.580 --> 00:06:12.675 the image that makes sense.

NOTE Confidence: 0.98632115

00:06:12.835 --> 00:06:13.875 So that will improve the

NOTE Confidence: 0.98632115

00:06:13.875 --> 00:06:14.375 throughput.

NOTE Confidence: 0.9624129

00:06:15.634 --> 00:06:17.714 This slide shows, some of

NOTE Confidence: 0.9624129

00:06:17.714 --> 00:06:19.895 our results and, and papers

NOTE Confidence: 0.9624129

00:06:19.955 --> 00:06:20.914 on this work where we

NOTE Confidence: 0.9624129

00:06:20.914 --> 00:06:23.074 use diffusion models to, predict

NOTE Confidence: 0.9624129

00:06:23.074 --> 00:06:25.074 confidence map, and we, show

NOTE Confidence: 0.9624129

00:06:25.074 --> 00:06:25.875 that we have,

NOTE Confidence: 0.99687684

00:06:26.370 --> 00:06:27.970 we tend to outperform existing

NOTE Confidence: 0.99687684

00:06:27.970 --> 00:06:29.089 state of the art methods

NOTE Confidence: 0.99687684

00:06:29.089 --> 00:06:30.870 using those advanced AI tools.

NOTE Confidence: 0.96024513

00:06:31.330 --> 00:06:32.690 We're also extending this work

NOTE Confidence: 0.96024513

00:06:32.690 --> 00:06:33.910 to head and neck tumors,

NOTE Confidence: 0.96024513

00:06:34.210 --> 00:06:35.650 where we're also developing new

NOTE Confidence: 0.96024513

00:06:35.650 --> 00:06:37.110 models that combine diffusions

NOTE Confidence: 0.80703366

00:06:37.490 --> 00:06:37.729 and,

NOTE Confidence: 0.97807205

00:06:38.290 --> 00:06:39.190 vision transformers,

NOTE Confidence: 0.80466485

00:06:40.154 --> 00:06:42.095 typical models using generative

NOTE Confidence: 0.94761866

00:06:42.714 --> 00:06:44.395 AI to improve the accuracy

NOTE Confidence: 0.94761866

00:06:44.395 --> 00:06:45.694 and the precision of segmentations.

NOTE Confidence: 0.9464433

00:06:46.555 --> 00:06:47.914 The second project I wanna

NOTE Confidence: 0.9464433

00:06:47.914 --> 00:06:50.395 touch on, is, prostate imaging

NOTE Confidence: 0.9464433

00:06:50.395 --> 00:06:51.435 where we're also trying to

NOTE Confidence: 0.9464433

00:06:51.435 --> 00:06:52.414 look at diagnostics

NOTE Confidence: 0.96082586

00:06:52.714 --> 00:06:53.995 and how AI can assist

NOTE Confidence: 0.96082586

00:06:53.995 --> 00:06:55.620 that. So as it was

NOTE Confidence: 0.96082586

00:06:55.620 --> 00:06:57.000 discussed in a previous talk,

NOTE Confidence: 0.96082586

00:06:57.220 --> 00:06:58.520 diagnostics will

NOTE Confidence: 0.9509423

00:06:58.980 --> 00:07:01.140 be able to, have injection

NOTE Confidence: 0.9509423

00:07:01.140 --> 00:07:02.260 of lutetium that will be

NOTE Confidence: 0.9509423

00:07:02.260 --> 00:07:03.380 imaged through the process. For

NOTE Confidence: 0.9509423

00:07:03.380 --> 00:07:04.500 the next few days, we

NOTE Confidence: 0.9509423

00:07:04.500 --> 00:07:05.240 can image

NOTE Confidence: 0.95851785

00:07:06.580 --> 00:07:08.279 we use inspect the lutetium,

NOTE Confidence: 0.95851785

00:07:08.339 --> 00:07:09.380 and we can build a

NOTE Confidence: 0.95851785

00:07:09.380 --> 00:07:10.155 dose map.

NOTE Confidence: 0.9580907

00:07:10.875 --> 00:07:12.155 This is a well known

NOTE Confidence: 0.9580907

00:07:12.155 --> 00:07:13.275 task how to estimate the

NOTE Confidence: 0.9580907

00:07:13.275 --> 00:07:14.315 dose from the spec. What

NOTE Confidence: 0.9580907

00:07:14.315 --> 00:07:15.195 we are trying to achieve

NOTE Confidence: 0.9580907

00:07:15.195 --> 00:07:15.695 is

NOTE Confidence: 0.9741261

00:07:16.315 --> 00:07:17.435 where we need the the

NOTE Confidence: 0.9741261

00:07:17.435 --> 00:07:18.794 AI tools. We're trying to

NOTE Confidence: 0.9741261

00:07:18.794 --> 00:07:19.995 see whether from the pet,

NOTE Confidence: 0.9741261

00:07:19.995 --> 00:07:21.115 we can get information on

NOTE Confidence: 0.9741261

00:07:21.115 --> 00:07:23.294 those. That's one. And second,

NOTE Confidence: 0.9741261

00:07:23.539 --> 00:07:24.740 from that dose, can we

NOTE Confidence: 0.9741261

00:07:24.740 --> 00:07:26.419 predict outcomes? Can we refine

NOTE Confidence: 0.9741261

00:07:26.419 --> 00:07:27.860 treatment? Can we personalize the

NOTE Confidence: 0.9741261

00:07:27.860 --> 00:07:29.720 treatment? And this is why,

NOTE Confidence: 0.9918205

00:07:30.259 --> 00:07:32.099 this is particularly challenging. It's

NOTE Confidence: 0.9918205

00:07:32.099 --> 00:07:33.380 challenging because the PET and

NOTE Confidence: 0.9918205

00:07:33.380 --> 00:07:34.819 the dose don't correlate the

NOTE Confidence: 0.9918205

00:07:34.819 --> 00:07:36.199 same way in different organs.

NOTE Confidence: 0.96631914

00:07:36.525 --> 00:07:38.045 So but it's very important

NOTE Confidence: 0.96631914

00:07:38.045 --> 00:07:38.925 for us to do it

NOTE Confidence: 0.96631914

00:07:38.925 --> 00:07:40.785 from the PET. One intermediate

NOTE Confidence: 0.96631914

00:07:40.845 --> 00:07:41.885 step we're trying to do

NOTE Confidence: 0.96631914

00:07:41.885 --> 00:07:43.005 is, well, from a single

NOTE Confidence: 0.96631914

00:07:43.005 --> 00:07:44.045 SPECT trying to get the

NOTE Confidence: 0.96631914

00:07:44.045 --> 00:07:45.645 dose. The reason why this

NOTE Confidence: 0.96631914

00:07:45.645 --> 00:07:46.765 is important to do from

NOTE Confidence: 0.96631914

00:07:46.765 --> 00:07:47.565 the PET is as we

NOTE Confidence: 0.96631914

00:07:47.565 --> 00:07:49.105 move from Lutetium to Actinium,

NOTE Confidence: 0.9695955

00:07:49.490 --> 00:07:50.370 SPECT is no longer an

NOTE Confidence: 0.9695955

00:07:50.370 --> 00:07:52.050 option. And so we PET

NOTE Confidence: 0.9695955

00:07:52.050 --> 00:07:52.850 is the only thing we

NOTE Confidence: 0.9695955

00:07:52.850 --> 00:07:54.370 can have to, assess the

NOTE Confidence: 0.9695955

00:07:54.370 --> 00:07:55.590 dose as we go.

NOTE Confidence: 0.9584656

00:07:56.450 --> 00:07:57.970 And that's why we're building

NOTE Confidence: 0.9584656

00:07:57.970 --> 00:07:59.730 this holistic framework where instead

NOTE Confidence: 0.9584656

00:07:59.730 --> 00:08:01.010 of having a treatment which

NOTE Confidence: 0.9584656

00:08:01.010 --> 00:08:02.050 is set once and for

NOTE Confidence: 0.9584656

00:08:02.050 --> 00:08:03.315 all and doesn't change, we're

NOTE Confidence: 0.9584656

00:08:03.315 --> 00:08:05.075 trying to use AI everywhere

NOTE Confidence: 0.9584656

00:08:05.075 --> 00:08:06.835 along the way to adjust,

NOTE Confidence: 0.9584656

00:08:06.835 --> 00:08:09.155 predict the outcomes, and refine

NOTE Confidence: 0.9584656

00:08:09.155 --> 00:08:10.435 the the planning, if anything,

NOTE Confidence: 0.9584656

00:08:10.435 --> 00:08:11.475 to know when to stop

NOTE Confidence: 0.9584656

00:08:11.475 --> 00:08:12.855 when treatment is working.

NOTE Confidence: 0.899865

00:08:13.795 --> 00:08:15.635 That concludes my talk on

NOTE Confidence: 0.899865

00:08:15.635 --> 00:08:16.915 this, and I will give

NOTE Confidence: 0.899865

00:08:16.915 --> 00:08:18.595 the microphone to jump on

NOTE Confidence: 0.899865

00:08:18.595 --> 00:08:19.050 the floor.

NOTE Confidence: 0.96105886

00:08:25.050 --> 00:08:26.330 Thank you. I am going

NOTE Confidence: 0.96105886

00:08:26.330 --> 00:08:27.930 to now talk for give

NOTE Confidence: 0.96105886

00:08:27.930 --> 00:08:29.129 you about the six minute

NOTE Confidence: 0.96105886

00:08:29.129 --> 00:08:29.629 overview

NOTE Confidence: 0.9989934

00:08:30.090 --> 00:08:32.270 of prostate cancer image analysis

NOTE Confidence: 0.9989934

00:08:32.410 --> 00:08:33.470 here at Yale.

NOTE Confidence: 0.9968654

00:08:34.025 --> 00:08:35.625 So prostate cancer is a

NOTE Confidence: 0.9968654

00:08:35.625 --> 00:08:36.684 global problem.

NOTE Confidence: 0.99570656

00:08:37.225 --> 00:08:38.585 In the United States alone,

NOTE Confidence: 0.99570656

00:08:38.585 --> 00:08:40.905 approximately eleven percent of males

NOTE Confidence: 0.99570656

00:08:40.905 --> 00:08:42.585 will receive a prostate cancer

NOTE Confidence: 0.99570656

00:08:42.585 --> 00:08:44.025 diagnosis over the course of

NOTE Confidence: 0.99570656

00:08:44.025 --> 00:08:44.765 their lives.

NOTE Confidence: 0.97771

00:08:45.545 --> 00:08:47.385 This means that prostate cancer

NOTE Confidence: 0.97771

00:08:47.385 --> 00:08:48.900 accounts for for approximately thirty

NOTE Confidence: 0.97771

00:08:48.900 --> 00:08:50.820 percent of cancers in men,

NOTE Confidence: 0.97771

00:08:50.820 --> 00:08:52.260 which is estimated to affect

NOTE Confidence: 0.97771

00:08:52.260 --> 00:08:53.640 more than three hundred thousand

NOTE Confidence: 0.97771

00:08:53.940 --> 00:08:55.220 and results in greater than

NOTE Confidence: 0.97771

00:08:55.220 --> 00:08:56.980 thirty five thousand deaths per

NOTE Confidence: 0.97771

00:08:56.980 --> 00:08:57.480 year.

NOTE Confidence: 0.9957707

00:08:58.660 --> 00:09:00.500 So imaging is a critical

NOTE Confidence: 0.9957707

00:09:00.500 --> 00:09:02.440 component found throughout the prostate

NOTE Confidence: 0.9957707

00:09:02.580 --> 00:09:03.080 cancer

NOTE Confidence: 0.99733603

00:09:03.655 --> 00:09:04.795 diagnostic pipeline.

NOTE Confidence: 0.9922768

00:09:05.495 --> 00:09:07.335 So after initial screening with

NOTE Confidence: 0.9922768

00:09:07.335 --> 00:09:09.515 prostate specific antigen blood testing,

NOTE Confidence: 0.9922768

00:09:09.815 --> 00:09:10.315 radiologists

NOTE Confidence: 0.90051377

00:09:10.855 --> 00:09:13.015 then interpret and read multi

NOTE Confidence: 0.90051377

00:09:13.015 --> 00:09:15.755 parametric MRI to identify suspected

NOTE Confidence: 0.90051377

00:09:15.815 --> 00:09:17.255 lesions according to the PI

NOTE Confidence: 0.90051377

00:09:17.255 --> 00:09:18.635 RADS reporting standard.

NOTE Confidence: 0.9956647

00:09:19.170 --> 00:09:21.089 Urologists then use ultrasound to

NOTE Confidence: 0.9956647

00:09:21.089 --> 00:09:22.630 perform image guided biopsy.

NOTE Confidence: 0.9996008

00:09:23.170 --> 00:09:23.670 Pathologists

NOTE Confidence: 0.9682589

00:09:24.130 --> 00:09:26.230 then interpret this biopsy tissue,

NOTE Confidence: 0.9682589

00:09:26.290 --> 00:09:27.809 which can be digitized using

NOTE Confidence: 0.9682589

00:09:27.809 --> 00:09:28.790 whole slide imaging.

NOTE Confidence: 0.9873655

00:09:29.170 --> 00:09:30.450 And then finally, the patient

NOTE Confidence: 0.9873655

00:09:30.450 --> 00:09:31.649 can be stratified into risk

NOTE Confidence: 0.9873655

00:09:31.649 --> 00:09:32.929 groups to determine whether they

NOTE Confidence: 0.9873655

00:09:32.929 --> 00:09:34.550 receive active surveillance

NOTE Confidence: 0.98237216

00:09:34.955 --> 00:09:35.915 or they go on to

NOTE Confidence: 0.98237216

00:09:35.915 --> 00:09:36.895 immediate treatment.

NOTE Confidence: 0.98495466

00:09:37.275 --> 00:09:38.715 Now imaging continues to be

NOTE Confidence: 0.98495466

00:09:38.715 --> 00:09:40.495 important during the treatment process.

NOTE Confidence: 0.7434203

00:09:41.115 --> 00:09:41.855 For example,

NOTE Confidence: 0.91730034

00:09:42.155 --> 00:09:43.755 PSMA PET and SPECT can

NOTE Confidence: 0.91730034

00:09:43.755 --> 00:09:44.895 be used for theranostics,

NOTE Confidence: 0.9947954

00:09:45.515 --> 00:09:47.275 as we've seen, and CT

NOTE Confidence: 0.9947954

00:09:47.275 --> 00:09:48.235 imaging can be used for

NOTE Confidence: 0.9947954

00:09:48.235 --> 00:09:49.375 radiation therapy.

NOTE Confidence: 0.9543492

00:09:50.900 --> 00:09:53.160 Image analysis powered by artificial

NOTE Confidence: 0.9543492

00:09:53.220 --> 00:09:55.160 intelligence and machine learning methods

NOTE Confidence: 0.94106406

00:09:55.620 --> 00:09:56.680 seeks to leverage,

NOTE Confidence: 0.985965

00:09:58.420 --> 00:10:00.340 all these imaging modalities to

NOTE Confidence: 0.985965

00:10:00.340 --> 00:10:02.340 enhance clinical insights. And this

NOTE Confidence: 0.985965

00:10:02.340 --> 00:10:03.700 is accomplished through a few

NOTE Confidence: 0.985965

00:10:03.700 --> 00:10:04.985 tasks such as classification,

NOTE Confidence: 0.99913687

00:10:05.605 --> 00:10:06.105 segmentation,

NOTE Confidence: 0.98876345

00:10:06.725 --> 00:10:08.425 registration, and data integration.

NOTE Confidence: 0.9837315

00:10:09.605 --> 00:10:10.485 So one of the first

NOTE Confidence: 0.9837315

00:10:10.485 --> 00:10:12.245 fundamental tasks in prostate image

NOTE Confidence: 0.9837315

00:10:12.245 --> 00:10:13.605 analysis is to segment the

NOTE Confidence: 0.9837315

00:10:13.605 --> 00:10:14.825 gland within MRI.

NOTE Confidence: 0.98401576

00:10:15.205 --> 00:10:16.325 Not only do these volume

NOTE Confidence: 0.98401576

00:10:16.325 --> 00:10:16.825 measurements,

NOTE Confidence: 0.9346416

00:10:17.210 --> 00:10:18.090 are they used to allow

NOTE Confidence: 0.9346416

00:10:18.090 --> 00:10:19.450 allow us to compute PSA

NOTE Confidence: 0.9346416

00:10:19.450 --> 00:10:19.950 density,

NOTE Confidence: 0.9777948

00:10:20.330 --> 00:10:21.210 but it also serves as

NOTE Confidence: 0.9777948

00:10:21.210 --> 00:10:22.730 a preprocessing step for many

NOTE Confidence: 0.9777948

00:10:22.730 --> 00:10:24.170 of the analyses that we'll

NOTE Confidence: 0.9777948

00:10:24.170 --> 00:10:26.170 see following here. However, this

NOTE Confidence: 0.9777948

00:10:26.170 --> 00:10:27.130 is a challenge due to

NOTE Confidence: 0.9777948

00:10:27.130 --> 00:10:28.890 the variability, the heterogeneity, the

NOTE Confidence: 0.9777948

00:10:28.890 --> 00:10:30.250 MR images themselves that you

NOTE Confidence: 0.9777948

00:10:30.250 --> 00:10:31.605 see in this picture. And

NOTE Confidence: 0.9777948

00:10:31.605 --> 00:10:33.765 additionally, these AI algorithms can

NOTE Confidence: 0.9777948

00:10:33.925 --> 00:10:35.445 are overly sensitive, can over

NOTE Confidence: 0.9777948

00:10:35.445 --> 00:10:36.825 train to the scanner themselves.

NOTE Confidence: 0.98933977

00:10:37.365 --> 00:10:39.765 So as demonstrated by techniques

NOTE Confidence: 0.98933977

00:10:39.765 --> 00:10:41.045 developed here at Yale, image

NOTE Confidence: 0.98933977

00:10:41.045 --> 00:10:42.825 analysis is critical to robustly

NOTE Confidence: 0.98933977

00:10:43.045 --> 00:10:44.804 apply these AI algorithms across

NOTE Confidence: 0.98933977

00:10:44.804 --> 00:10:46.265 different clinical sites.

NOTE Confidence: 0.9076363

00:10:46.800 --> 00:10:47.920 And note for all of

NOTE Confidence: 0.9076363

00:10:47.920 --> 00:10:48.980 you AI users,

NOTE Confidence: 0.93420357

00:10:49.520 --> 00:10:50.800 don't ever trust an algorithm

NOTE Confidence: 0.93420357

00:10:50.800 --> 00:10:52.720 unless you validate against, like,

NOTE Confidence: 0.93420357

00:10:52.720 --> 00:10:54.260 multi site data or external

NOTE Confidence: 0.93420357

00:10:54.320 --> 00:10:55.460 data. K?

NOTE Confidence: 0.9504081

00:10:55.920 --> 00:10:57.780 So going beyond gland segmentation,

NOTE Confidence: 0.9504081

00:10:57.920 --> 00:10:59.600 we also wanna differentiate different

NOTE Confidence: 0.9504081

00:10:59.600 --> 00:11:01.095 zonal anatomy of the prostate,

NOTE Confidence: 0.9504081

00:11:01.095 --> 00:11:01.975 which is part of their

NOTE Confidence: 0.9504081

00:11:01.975 --> 00:11:03.834 PyRAADS reporting, system.

NOTE Confidence: 0.99481505

00:11:04.214 --> 00:11:05.334 In this work here, we

NOTE Confidence: 0.99481505

00:11:05.334 --> 00:11:07.654 directly integrated both anatomical and

NOTE Confidence: 0.99481505

00:11:07.654 --> 00:11:09.735 geometric constraints to segment this

NOTE Confidence: 0.99481505

00:11:09.735 --> 00:11:10.714 challenging boundary.

NOTE Confidence: 0.96656823

00:11:11.975 --> 00:11:13.595 This approach has been directly

NOTE Confidence: 0.96656823

00:11:13.735 --> 00:11:14.235 translated,

NOTE Confidence: 0.99904346

00:11:14.855 --> 00:11:16.154 into clinical use

NOTE Confidence: 0.9178577

00:11:17.280 --> 00:11:19.280 by our commercial partners, Eigen

NOTE Confidence: 0.9178577

00:11:19.280 --> 00:11:20.900 Health, into their, ProFuseCAD

NOTE Confidence: 0.9928794

00:11:21.280 --> 00:11:22.720 software platform. So this is

NOTE Confidence: 0.9928794

00:11:22.720 --> 00:11:23.840 pretty exciting to see it

NOTE Confidence: 0.9928794

00:11:23.840 --> 00:11:25.200 actually going from the lab

NOTE Confidence: 0.9928794

00:11:25.200 --> 00:11:26.340 to the real world.

NOTE Confidence: 0.97386795

00:11:27.360 --> 00:11:29.140 And our final MRI segmentation

NOTE Confidence: 0.97386795

00:11:29.280 --> 00:11:30.880 application here is to identify

NOTE Confidence: 0.97386795

00:11:30.880 --> 00:11:31.380 lesions,

NOTE Confidence: 0.9692432

00:11:31.764 --> 00:11:33.524 which are extremely challenging to

NOTE Confidence: 0.9692432

00:11:33.524 --> 00:11:35.704 identify even for experienced radiologists.

NOTE Confidence: 0.98675334

00:11:36.485 --> 00:11:37.764 So to tackle this problem

NOTE Confidence: 0.98675334

00:11:37.764 --> 00:11:39.365 here, we developed an approach

NOTE Confidence: 0.98675334

00:11:39.365 --> 00:11:41.684 that directly integrates clinical data,

NOTE Confidence: 0.98675334

00:11:41.684 --> 00:11:42.904 in this case, PSA,

NOTE Confidence: 0.99955994

00:11:43.365 --> 00:11:44.345 into the segmentation

NOTE Confidence: 0.99902946

00:11:44.725 --> 00:11:45.225 process.

NOTE Confidence: 0.9632656

00:11:45.770 --> 00:11:46.730 So this human in the

NOTE Confidence: 0.9632656

00:11:46.730 --> 00:11:48.490 loop approach allows the radiate

NOTE Confidence: 0.9632656

00:11:48.650 --> 00:11:50.330 radiologist then to mimic the

NOTE Confidence: 0.9632656

00:11:50.330 --> 00:11:52.350 variability in PSA levels

NOTE Confidence: 0.9316983

00:11:52.730 --> 00:11:53.770 and is able and you're

NOTE Confidence: 0.9316983

00:11:53.770 --> 00:11:55.130 able to visualize the effect

NOTE Confidence: 0.9316983

00:11:55.130 --> 00:11:56.270 it has on the algorithm

NOTE Confidence: 0.9316983

00:11:56.410 --> 00:11:56.910 segmentation

NOTE Confidence: 0.97883844

00:11:57.210 --> 00:11:58.274 output. So from this image

NOTE Confidence: 0.97883844

00:11:58.274 --> 00:11:59.154 here you can see from

NOTE Confidence: 0.97883844

00:11:59.154 --> 00:12:00.454 left to right as you

NOTE Confidence: 0.97883844

00:12:00.514 --> 00:12:02.295 increase the PSA value

NOTE Confidence: 0.9389699

00:12:02.675 --> 00:12:04.834 the lesion actually grows during

NOTE Confidence: 0.9389699

00:12:04.834 --> 00:12:06.214 the segmentation process.

NOTE Confidence: 0.97122055

00:12:07.075 --> 00:12:08.774 This too is being integrated

NOTE Confidence: 0.97122055

00:12:08.834 --> 00:12:10.595 into the ProFuseCAD system, so

NOTE Confidence: 0.97122055

00:12:10.595 --> 00:12:12.214 another good example of translational

NOTE Confidence: 0.97122055

00:12:12.514 --> 00:12:13.334 science here.

NOTE Confidence: 0.9728194

00:12:14.220 --> 00:12:15.920 We can also perform classification

NOTE Confidence: 0.9728194

00:12:16.059 --> 00:12:17.660 using the MRI to predict

NOTE Confidence: 0.9728194

00:12:17.660 --> 00:12:19.260 if patients have benign, non

NOTE Confidence: 0.9728194

00:12:19.260 --> 00:12:21.260 significant disease, or clinically significant

NOTE Confidence: 0.9728194

00:12:21.260 --> 00:12:23.260 prostate cancer. So as shown

NOTE Confidence: 0.9728194

00:12:23.260 --> 00:12:24.300 here, using the image by

NOTE Confidence: 0.9728194

00:12:24.300 --> 00:12:25.980 itself is quite underwhelming in

NOTE Confidence: 0.9728194

00:12:25.980 --> 00:12:27.105 this AUC curve.

NOTE Confidence: 0.96278566

00:12:27.425 --> 00:12:29.505 However, by integrating additional clinical

NOTE Confidence: 0.96278566

00:12:29.505 --> 00:12:31.125 data such as patient age,

NOTE Confidence: 0.96278566

00:12:31.264 --> 00:12:32.885 PSA, and PI RADS reporting,

NOTE Confidence: 0.96278566

00:12:33.105 --> 00:12:34.704 we see the synergistic effect

NOTE Confidence: 0.96278566

00:12:34.704 --> 00:12:36.704 where that significantly enhances the

NOTE Confidence: 0.96278566

00:12:36.704 --> 00:12:38.084 prostate cancer classification

NOTE Confidence: 0.9991578

00:12:38.385 --> 00:12:38.885 performance.

NOTE Confidence: 0.9926471

00:12:40.480 --> 00:12:42.500 Next, during the biopsy procedure,

NOTE Confidence: 0.9926471

00:12:42.640 --> 00:12:44.320 lesions are extremely challenging to

NOTE Confidence: 0.9926471

00:12:44.320 --> 00:12:46.100 identify in the ultrasound image.

NOTE Confidence: 0.9926471

00:12:46.240 --> 00:12:47.360 Therefore, what we want to

NOTE Confidence: 0.9926471

00:12:47.360 --> 00:12:48.800 use is MRI to identify

NOTE Confidence: 0.9926471

00:12:48.800 --> 00:12:50.580 lesions of interest for targeted

NOTE Confidence: 0.9926471

00:12:50.640 --> 00:12:51.140 biopsy.

NOTE Confidence: 0.9892117

00:12:51.575 --> 00:12:52.955 The challenge here is coregistration

NOTE Confidence: 0.9892117

00:12:53.175 --> 00:12:54.615 or aligning these two vastly

NOTE Confidence: 0.9892117

00:12:54.615 --> 00:12:55.835 different imaging modalities.

NOTE Confidence: 0.9796852

00:12:56.375 --> 00:12:57.815 So to overcome this hurdle,

NOTE Confidence: 0.9796852

00:12:57.815 --> 00:12:58.934 we use a surface based

NOTE Confidence: 0.9796852

00:12:58.934 --> 00:13:00.535 registration approach that uses the

NOTE Confidence: 0.9796852

00:13:00.535 --> 00:13:02.054 segmentations for both the MRI

NOTE Confidence: 0.9796852

00:13:02.054 --> 00:13:02.795 and the ultrasound.

NOTE Confidence: 0.9197223

00:13:03.590 --> 00:13:05.450 Here we incorporated a geometric

NOTE Confidence: 0.9197223

00:13:05.750 --> 00:13:06.250 model,

NOTE Confidence: 0.99861246

00:13:06.790 --> 00:13:08.470 to model the deformation of

NOTE Confidence: 0.99861246

00:13:08.470 --> 00:13:10.010 the gland during the biopsy

NOTE Confidence: 0.99861246

00:13:10.070 --> 00:13:11.670 procedure to improve this image

NOTE Confidence: 0.99861246

00:13:11.670 --> 00:13:12.650 fusion process.

NOTE Confidence: 0.9966776

00:13:14.470 --> 00:13:15.590 Once we have the needle

NOTE Confidence: 0.9966776

00:13:15.590 --> 00:13:17.365 biopsy specimens, a challenge is

NOTE Confidence: 0.9966776

00:13:17.365 --> 00:13:18.324 then to determine if the

NOTE Confidence: 0.9966776

00:13:18.324 --> 00:13:20.165 full extent of tissue in

NOTE Confidence: 0.9966776

00:13:20.165 --> 00:13:20.904 that gland

NOTE Confidence: 0.94437313

00:13:21.285 --> 00:13:23.125 when this biopsy constitutes only

NOTE Confidence: 0.94437313

00:13:23.125 --> 00:13:24.404 a small fraction of the

NOTE Confidence: 0.94437313

00:13:24.404 --> 00:13:25.304 gland sampling.

NOTE Confidence: 0.9876118

00:13:25.845 --> 00:13:27.444 So using AI, we can

NOTE Confidence: 0.9876118

00:13:27.444 --> 00:13:28.665 then map this histopathology

NOTE Confidence: 0.99005175

00:13:29.285 --> 00:13:30.824 results back to the MRI

NOTE Confidence: 0.99005175

00:13:30.884 --> 00:13:32.105 to fill in the gaps.

NOTE Confidence: 0.9774494

00:13:32.610 --> 00:13:33.890 In this way, by identifying

NOTE Confidence: 0.9774494

00:13:33.890 --> 00:13:35.170 tissue with similar properties to

NOTE Confidence: 0.9774494

00:13:35.170 --> 00:13:36.610 the needle biopsy specimens, we

NOTE Confidence: 0.9774494

00:13:36.610 --> 00:13:37.649 can provide a full three

NOTE Confidence: 0.9774494

00:13:37.649 --> 00:13:39.750 d comprehensive assessment of disease

NOTE Confidence: 0.9774494

00:13:39.809 --> 00:13:41.110 risk throughout the gland.

NOTE Confidence: 0.909732

00:13:43.490 --> 00:13:45.190 Also, as Tiba already mentioned,

NOTE Confidence: 0.95398736

00:13:45.625 --> 00:13:47.545 segmentation is great, but the

NOTE Confidence: 0.95398736

00:13:47.545 --> 00:13:48.045 real,

NOTE Confidence: 0.9783916

00:13:48.505 --> 00:13:50.505 critical practical question is, can

NOTE Confidence: 0.9783916

00:13:50.505 --> 00:13:52.105 we trust our predictions? So

NOTE Confidence: 0.9783916

00:13:52.105 --> 00:13:53.145 we've been at the forefront

NOTE Confidence: 0.9783916

00:13:53.145 --> 00:13:54.585 of developing methods to try

NOTE Confidence: 0.9783916

00:13:54.585 --> 00:13:56.265 to quantify uncertainty. And as

NOTE Confidence: 0.9783916

00:13:56.265 --> 00:13:56.985 you can see in the

NOTE Confidence: 0.9783916

00:13:56.985 --> 00:13:58.980 picture here, our frequency domain

NOTE Confidence: 0.9783916

00:13:58.980 --> 00:14:00.660 dropout here performs better in

NOTE Confidence: 0.9783916

00:14:00.660 --> 00:14:02.680 identifying the segmentation errors.

NOTE Confidence: 0.99609303

00:14:03.380 --> 00:14:04.360 So in pathology,

NOTE Confidence: 0.99061733

00:14:04.900 --> 00:14:05.700 one of the things that

NOTE Confidence: 0.99061733

00:14:05.700 --> 00:14:07.060 we're interested in is segmenting

NOTE Confidence: 0.99061733

00:14:07.060 --> 00:14:08.420 tissue and whole slide imaging.

NOTE Confidence: 0.99061733

00:14:08.420 --> 00:14:09.640 One of the major limitations

NOTE Confidence: 0.99061733

00:14:09.700 --> 00:14:10.980 of AI is that approaches

NOTE Confidence: 0.99061733

00:14:10.980 --> 00:14:12.100 are sensitive to how the

NOTE Confidence: 0.99061733

00:14:12.100 --> 00:14:13.160 data is oriented.

NOTE Confidence: 0.9331545

00:14:13.540 --> 00:14:14.865 So So as as that

NOTE Confidence: 0.9331545

00:14:14.865 --> 00:14:17.105 data rotates, biomarkers actually rotate

NOTE Confidence: 0.9331545

00:14:17.105 --> 00:14:18.545 around and they change position,

NOTE Confidence: 0.9331545

00:14:18.545 --> 00:14:19.425 which is bad for our

NOTE Confidence: 0.9331545

00:14:19.425 --> 00:14:19.925 performance.

NOTE Confidence: 0.97102696

00:14:20.945 --> 00:14:22.305 We've developed this new method

NOTE Confidence: 0.97102696

00:14:22.305 --> 00:14:23.605 that is able to robustly

NOTE Confidence: 0.97102696

00:14:23.824 --> 00:14:25.345 handle these features. So as

NOTE Confidence: 0.97102696

00:14:25.345 --> 00:14:26.805 the image rotates, the biomarker

NOTE Confidence: 0.97102696

00:14:26.945 --> 00:14:27.764 stays stable.

NOTE Confidence: 0.97370845

00:14:28.070 --> 00:14:29.350 Once we have these stable

NOTE Confidence: 0.97370845

00:14:29.350 --> 00:14:30.970 biomarkers we can then robustly

NOTE Confidence: 0.97370845

00:14:31.190 --> 00:14:32.950 segment the pathology images in

NOTE Confidence: 0.97370845

00:14:32.950 --> 00:14:34.330 an unsupervised manner.

NOTE Confidence: 0.97738457

00:14:35.750 --> 00:14:37.190 So finally, we're seeking to

NOTE Confidence: 0.97738457

00:14:37.190 --> 00:14:38.890 apply these image analysis approaches

NOTE Confidence: 0.97738457

00:14:39.029 --> 00:14:40.709 to treatment imaging such as

NOTE Confidence: 0.97738457

00:14:40.709 --> 00:14:41.209 theranostics

NOTE Confidence: 0.93821615

00:14:41.835 --> 00:14:42.955 And so these show some

NOTE Confidence: 0.93821615

00:14:42.955 --> 00:14:45.535 initial results segmenting tumor METs

NOTE Confidence: 0.93821615

00:14:45.595 --> 00:14:46.075 in,

NOTE Confidence: 0.93012613

00:14:46.555 --> 00:14:48.715 PSMA PET, and we're trying

NOTE Confidence: 0.93012613

00:14:48.715 --> 00:14:50.315 to quantify tumor burden throughout

NOTE Confidence: 0.93012613

00:14:50.315 --> 00:14:52.155 the body making this a

NOTE Confidence: 0.93012613

00:14:52.155 --> 00:14:53.675 really time consuming task more

NOTE Confidence: 0.93012613

00:14:53.675 --> 00:14:54.735 efficient and precise.

NOTE Confidence: 0.9732287

00:14:55.700 --> 00:14:57.400 So in summary, image analysis

NOTE Confidence: 0.9732287

00:14:57.620 --> 00:14:59.320 integrates multimodal data

NOTE Confidence: 0.91667265

00:14:59.700 --> 00:15:01.060 powered by AI is really

NOTE Confidence: 0.91667265

00:15:01.060 --> 00:15:02.260 a critical component in our

NOTE Confidence: 0.91667265

00:15:02.260 --> 00:15:04.420 toolbox for fight, fighting prostate

NOTE Confidence: 0.91667265

00:15:04.420 --> 00:15:04.920 cancer.

NOTE Confidence: 0.94894356

00:15:05.460 --> 00:15:06.420 So thank you for your

NOTE Confidence: 0.94894356

00:15:06.420 --> 00:15:07.380 time, and as we'll see

NOTE Confidence: 0.94894356

00:15:07.380 --> 00:15:08.740 next with Nisha that these

NOTE Confidence: 0.94894356

00:15:08.740 --> 00:15:10.020 similar methods can be applied

NOTE Confidence: 0.94894356

00:15:10.020 --> 00:15:11.595 also to breast cancer. So

NOTE Confidence: 0.94894356

00:15:11.595 --> 00:15:12.334 thank you.

NOTE Confidence: 0.9504021

00:15:18.394 --> 00:15:19.755 Hi, everyone. Again, my name

NOTE Confidence: 0.9504021

00:15:19.755 --> 00:15:21.274 is Nisha Dvornick, and thanks,

NOTE Confidence: 0.9504021

00:15:21.514 --> 00:15:23.514 first to the Imaging Institute

NOTE Confidence: 0.9504021

00:15:23.514 --> 00:15:24.714 leaders for this opportunity to

NOTE Confidence: 0.9504021

00:15:24.714 --> 00:15:25.514 share some of our work

NOTE Confidence: 0.9504021

00:15:25.514 --> 00:15:26.975 today in breast cancer imaging.

NOTE Confidence: 0.9972362

00:15:28.470 --> 00:15:29.510 So breast cancer is one

NOTE Confidence: 0.9972362

00:15:29.510 --> 00:15:30.230 of the most common and

NOTE Confidence: 0.9972362

00:15:30.230 --> 00:15:31.450 deadly cancers worldwide

NOTE Confidence: 0.9342308

00:15:31.990 --> 00:15:33.190 and the lifetime risk for

NOTE Confidence: 0.9342308

00:15:33.190 --> 00:15:34.070 women here in the US

NOTE Confidence: 0.9342308

00:15:34.070 --> 00:15:35.370 is about one in eight.

NOTE Confidence: 0.9898835

00:15:36.630 --> 00:15:38.230 Breast imaging plays a critical

NOTE Confidence: 0.9898835

00:15:38.230 --> 00:15:40.310 role from screening, to treatment

NOTE Confidence: 0.9898835

00:15:40.310 --> 00:15:41.210 of breast cancer.

NOTE Confidence: 0.99509025

00:15:41.865 --> 00:15:42.845 For example, mammography,

NOTE Confidence: 0.9771942

00:15:43.385 --> 00:15:44.665 type of X-ray imaging is

NOTE Confidence: 0.9771942

00:15:44.665 --> 00:15:46.185 the most commonly used modality

NOTE Confidence: 0.9771942

00:15:46.185 --> 00:15:47.385 for breast cancer screening and

NOTE Confidence: 0.9771942

00:15:47.385 --> 00:15:49.005 also used for diagnostic workup.

NOTE Confidence: 0.9694832

00:15:50.345 --> 00:15:51.945 MRI is used for high

NOTE Confidence: 0.9694832

00:15:51.945 --> 00:15:53.385 risk screening. We all heard

NOTE Confidence: 0.9694832

00:15:53.385 --> 00:15:54.745 with Todd Constable's work that

NOTE Confidence: 0.9694832

00:15:54.745 --> 00:15:56.400 eventually this affordable MRI will

NOTE Confidence: 0.9694832

00:15:56.400 --> 00:15:57.760 be for all women for

NOTE Confidence: 0.9694832

00:15:57.760 --> 00:15:58.880 screening, but for now it's

NOTE Confidence: 0.9694832

00:15:58.880 --> 00:16:00.100 just for high risk screening,

NOTE Confidence: 0.9791126

00:16:00.560 --> 00:16:02.320 for diagnosis, and also treatment

NOTE Confidence: 0.9791126

00:16:02.320 --> 00:16:03.520 planning and monitoring to see

NOTE Confidence: 0.9791126

00:16:03.520 --> 00:16:04.660 the extent of tumors.

NOTE Confidence: 0.9400416

00:16:05.600 --> 00:16:07.440 And finally, ultrasound imaging is

NOTE Confidence: 0.9400416

00:16:07.440 --> 00:16:08.264 used for for screening in

NOTE Confidence: 0.9400416

00:16:08.264 --> 00:16:10.584 some circumstances, diagnosis, and for

NOTE Confidence: 0.9400416

00:16:10.584 --> 00:16:11.565 biopsy guidance.

NOTE Confidence: 0.9667674

00:16:13.144 --> 00:16:14.504 Now analyzing all of these

NOTE Confidence: 0.9667674

00:16:14.504 --> 00:16:15.625 images faces a number of

NOTE Confidence: 0.9667674

00:16:15.625 --> 00:16:17.545 challenges including the large quantity

NOTE Confidence: 0.9667674

00:16:17.545 --> 00:16:19.305 of data, a growing shortage

NOTE Confidence: 0.9667674

00:16:19.305 --> 00:16:21.324 of breast radiologists, and subjective

NOTE Confidence: 0.9667674

00:16:21.384 --> 00:16:23.324 interpretation that depends on expertise.

NOTE Confidence: 0.9732718

00:16:25.040 --> 00:16:26.560 So to address these challenges,

NOTE Confidence: 0.9732718

00:16:26.560 --> 00:16:28.160 our group is developing novel

NOTE Confidence: 0.9732718

00:16:28.160 --> 00:16:30.080 approaches to enhance the analysis

NOTE Confidence: 0.9732718

00:16:30.080 --> 00:16:30.980 of breast images

NOTE Confidence: 0.9467578

00:16:31.280 --> 00:16:33.120 and we're adopting modern AI

NOTE Confidence: 0.9467578

00:16:33.120 --> 00:16:35.120 methods such as contrastive pre

NOTE Confidence: 0.9467578

00:16:35.120 --> 00:16:36.320 training to learn how to

NOTE Confidence: 0.9467578

00:16:36.320 --> 00:16:37.540 best model our data,

NOTE Confidence: 0.9883745

00:16:38.845 --> 00:16:41.085 utilizing multimodal image and text

NOTE Confidence: 0.9883745

00:16:41.085 --> 00:16:41.585 information,

NOTE Confidence: 0.9935259

00:16:41.965 --> 00:16:43.485 and leveraging domain knowledge of

NOTE Confidence: 0.9935259

00:16:43.485 --> 00:16:44.925 the imaging process to better

NOTE Confidence: 0.9935259

00:16:44.925 --> 00:16:46.705 constrain the image analysis models.

NOTE Confidence: 0.9861123

00:16:48.205 --> 00:16:49.165 So I'd like to just

NOTE Confidence: 0.9861123

00:16:49.165 --> 00:16:50.285 introduce a bit this idea

NOTE Confidence: 0.9861123

00:16:50.285 --> 00:16:51.725 of contrastive pre training for

NOTE Confidence: 0.9861123

00:16:51.725 --> 00:16:53.085 learning how to model or

NOTE Confidence: 0.9861123

00:16:53.085 --> 00:16:54.899 best represent this these imaging

NOTE Confidence: 0.9861123

00:16:54.899 --> 00:16:55.399 data.

NOTE Confidence: 0.99795747

00:16:55.860 --> 00:16:56.820 So the goal here is

NOTE Confidence: 0.99795747

00:16:56.820 --> 00:16:57.960 to learn a mapping

NOTE Confidence: 0.84852827

00:16:58.899 --> 00:16:59.940 oh, this is gone a

NOTE Confidence: 0.84852827

00:16:59.940 --> 00:17:01.060 mapping which is this image

NOTE Confidence: 0.84852827

00:17:01.060 --> 00:17:01.560 encoder,

NOTE Confidence: 0.9806483

00:17:02.100 --> 00:17:03.140 from the image to an

NOTE Confidence: 0.9806483

00:17:03.140 --> 00:17:04.580 embedding space where the image

NOTE Confidence: 0.9806483

00:17:04.580 --> 00:17:05.700 data will then be organized

NOTE Confidence: 0.9806483

00:17:05.700 --> 00:17:06.500 in a way that's easier

NOTE Confidence: 0.9806483

00:17:06.500 --> 00:17:08.280 to analyze in downstream tasks.

NOTE Confidence: 0.9530365

00:17:08.884 --> 00:17:09.764 So say we have this

NOTE Confidence: 0.9530365

00:17:09.764 --> 00:17:11.365 mammogram, it gets input through

NOTE Confidence: 0.9530365

00:17:11.365 --> 00:17:12.404 our image encoder and it

NOTE Confidence: 0.9530365

00:17:12.404 --> 00:17:13.544 maps to some embedding,

NOTE Confidence: 0.9681314

00:17:14.484 --> 00:17:15.764 and now we have another

NOTE Confidence: 0.9681314

00:17:15.764 --> 00:17:17.205 image, for the same patient

NOTE Confidence: 0.9681314

00:17:17.205 --> 00:17:18.804 but a different view, goes

NOTE Confidence: 0.9681314

00:17:18.804 --> 00:17:20.004 through this encoder, gets a

NOTE Confidence: 0.9681314

00:17:20.004 --> 00:17:20.825 different embedding,

NOTE Confidence: 0.95323914

00:17:21.440 --> 00:17:22.080 and now we have a

NOTE Confidence: 0.95323914

00:17:22.080 --> 00:17:23.600 third mammogram that comes from

NOTE Confidence: 0.95323914

00:17:23.600 --> 00:17:24.960 a different patient and goes

NOTE Confidence: 0.95323914

00:17:24.960 --> 00:17:26.000 through the same encoder and

NOTE Confidence: 0.95323914

00:17:26.000 --> 00:17:27.280 lands right there at the

NOTE Confidence: 0.95323914

00:17:27.280 --> 00:17:28.020 green triangle.

NOTE Confidence: 0.9885855

00:17:28.480 --> 00:17:29.520 So now the idea in

NOTE Confidence: 0.9885855

00:17:29.520 --> 00:17:30.720 contrastive learning is to learn

NOTE Confidence: 0.9885855

00:17:30.720 --> 00:17:32.480 this embedding where similar data

NOTE Confidence: 0.9885855

00:17:32.480 --> 00:17:33.359 are going to live closer

NOTE Confidence: 0.9885855

00:17:33.359 --> 00:17:34.640 together in this high dimensional

NOTE Confidence: 0.9885855

00:17:34.640 --> 00:17:36.080 space and dissimilar data are

NOTE Confidence: 0.9885855

00:17:36.080 --> 00:17:37.335 going to live farther apart.

NOTE Confidence: 0.967777

00:17:37.734 --> 00:17:39.434 So the contrastive learning algorithm

NOTE Confidence: 0.967777

00:17:39.575 --> 00:17:40.615 in this case is gonna

NOTE Confidence: 0.967777

00:17:40.615 --> 00:17:41.895 work to align these blue

NOTE Confidence: 0.967777

00:17:41.895 --> 00:17:43.414 circles that represent the images

NOTE Confidence: 0.967777

00:17:43.414 --> 00:17:44.475 from the same patient

NOTE Confidence: 0.9915456

00:17:44.934 --> 00:17:46.135 while seeking to push apart

NOTE Confidence: 0.9915456

00:17:46.135 --> 00:17:47.335 data that come from different

NOTE Confidence: 0.9915456

00:17:47.335 --> 00:17:47.835 patients.

NOTE Confidence: 0.9983404

00:17:48.135 --> 00:17:49.255 And once we've learned this

NOTE Confidence: 0.9983404

00:17:49.255 --> 00:17:51.034 embedding and this useful representation

NOTE Confidence: 0.9983404

00:17:51.174 --> 00:17:52.480 of the data, we can

NOTE Confidence: 0.9983404

00:17:52.480 --> 00:17:53.919 build more accurate models for

NOTE Confidence: 0.9983404

00:17:53.919 --> 00:17:55.519 different image analysis tasks on

NOTE Confidence: 0.9983404

00:17:55.519 --> 00:17:56.340 top of it.

NOTE Confidence: 0.90375763

00:17:57.200 --> 00:17:58.880 So we use this image

NOTE Confidence: 0.90375763

00:17:58.880 --> 00:18:00.240 contrast to pre training approach

NOTE Confidence: 0.90375763

00:18:00.240 --> 00:18:01.679 to improve the identification of

NOTE Confidence: 0.90375763

00:18:01.679 --> 00:18:03.519 abnormal digital breast tumor synthesis

NOTE Confidence: 0.90375763

00:18:03.519 --> 00:18:04.880 scans, also known as three

NOTE Confidence: 0.90375763

00:18:04.880 --> 00:18:05.539 d mammography.

NOTE Confidence: 0.9747213

00:18:06.154 --> 00:18:07.355 And here our framework looks

NOTE Confidence: 0.9747213

00:18:07.355 --> 00:18:08.394 to align an image slice

NOTE Confidence: 0.9747213

00:18:08.394 --> 00:18:09.755 from a tonal volume with

NOTE Confidence: 0.9747213

00:18:09.755 --> 00:18:10.794 other slices from the same

NOTE Confidence: 0.9747213

00:18:10.794 --> 00:18:11.994 patient while pushing away the

NOTE Confidence: 0.9747213

00:18:11.994 --> 00:18:13.455 images from the other patients.

NOTE Confidence: 0.95731026

00:18:14.315 --> 00:18:16.075 After we've performed this contrastive

NOTE Confidence: 0.95731026

00:18:16.075 --> 00:18:17.514 pre training, we fine tune

NOTE Confidence: 0.95731026

00:18:17.514 --> 00:18:18.394 the model to learn to

NOTE Confidence: 0.95731026

00:18:18.394 --> 00:18:20.174 predict whether an input tomosynthesis

NOTE Confidence: 0.95731026

00:18:20.394 --> 00:18:21.855 slice is normal or abnormal.

NOTE Confidence: 0.9637464

00:18:23.010 --> 00:18:23.970 And as we can see

NOTE Confidence: 0.9637464

00:18:23.970 --> 00:18:24.869 in this performance,

NOTE Confidence: 0.9916069

00:18:25.250 --> 00:18:26.550 ROC curves here

NOTE Confidence: 0.9414684

00:18:27.010 --> 00:18:28.050 compared to the other pre

NOTE Confidence: 0.9414684

00:18:28.050 --> 00:18:28.950 training approaches,

NOTE Confidence: 0.96274865

00:18:29.650 --> 00:18:30.930 down below our model in

NOTE Confidence: 0.96274865

00:18:30.930 --> 00:18:32.390 red performs the best

NOTE Confidence: 0.9566834

00:18:32.850 --> 00:18:34.210 and in particular we achieved

NOTE Confidence: 0.9566834

00:18:34.210 --> 00:18:35.490 a very high negative predictive

NOTE Confidence: 0.9566834

00:18:35.490 --> 00:18:36.875 value suggesting we might be

NOTE Confidence: 0.9566834

00:18:36.875 --> 00:18:37.755 able to use this to

NOTE Confidence: 0.9566834

00:18:37.755 --> 00:18:38.955 filter out negative cases and

NOTE Confidence: 0.9566834

00:18:38.955 --> 00:18:40.494 reduce the radiologists workload.

NOTE Confidence: 0.96055776

00:18:42.635 --> 00:18:44.394 We then extended this contrastive

NOTE Confidence: 0.96055776

00:18:44.394 --> 00:18:45.835 pre training approach to align

NOTE Confidence: 0.96055776

00:18:45.835 --> 00:18:47.914 images and radiology reports. So

NOTE Confidence: 0.96055776

00:18:47.914 --> 00:18:49.375 this general method of aligning

NOTE Confidence: 0.96055776

00:18:49.595 --> 00:18:50.794 image and text data is

NOTE Confidence: 0.96055776

00:18:50.794 --> 00:18:52.350 known as contrastive language pre

NOTE Confidence: 0.96055776

00:18:52.350 --> 00:18:53.330 training or CLIP.

NOTE Confidence: 0.9901845

00:18:53.630 --> 00:18:54.590 So now in addition to

NOTE Confidence: 0.9901845

00:18:54.590 --> 00:18:55.710 the image encoder, we now

NOTE Confidence: 0.9901845

00:18:55.710 --> 00:18:56.990 have this text encoder to

NOTE Confidence: 0.9901845

00:18:56.990 --> 00:18:58.510 map the radiology reports into

NOTE Confidence: 0.9901845

00:18:58.510 --> 00:19:00.290 now this shared embedding space.

NOTE Confidence: 0.99416155

00:19:00.910 --> 00:19:01.810 And the contrastive,

NOTE Confidence: 0.9991733

00:19:02.590 --> 00:19:04.190 learning algorithm is going to

NOTE Confidence: 0.9991733

00:19:04.190 --> 00:19:05.170 now try to

NOTE Confidence: 0.9635868

00:19:05.475 --> 00:19:07.234 align the paired image and

NOTE Confidence: 0.9635868

00:19:07.234 --> 00:19:09.075 radiology reports and at the

NOTE Confidence: 0.9635868

00:19:09.075 --> 00:19:10.195 same time push away other

NOTE Confidence: 0.9635868

00:19:10.195 --> 00:19:11.395 reports that were not related

NOTE Confidence: 0.9635868

00:19:11.395 --> 00:19:12.455 to the target image

NOTE Confidence: 0.99391055

00:19:12.755 --> 00:19:13.955 and push away other images

NOTE Confidence: 0.99391055

00:19:13.955 --> 00:19:14.755 that are not related to

NOTE Confidence: 0.99391055

00:19:14.755 --> 00:19:15.734 the target report.

NOTE Confidence: 0.91350377

00:19:16.994 --> 00:19:18.180 So we use this CLIP

NOTE Confidence: 0.91350377

00:19:18.260 --> 00:19:19.380 framework to perform a multi

NOTE Confidence: 0.91350377

00:19:19.380 --> 00:19:20.820 view and multi scale alignment

NOTE Confidence: 0.91350377

00:19:20.820 --> 00:19:22.119 from mammography data

NOTE Confidence: 0.94798183

00:19:22.500 --> 00:19:24.260 where our model considers again

NOTE Confidence: 0.94798183

00:19:24.260 --> 00:19:26.180 this multi view image alignment

NOTE Confidence: 0.94798183

00:19:26.180 --> 00:19:27.380 at top, similar to the

NOTE Confidence: 0.94798183

00:19:27.380 --> 00:19:29.220 tone synthesis model. And then

NOTE Confidence: 0.94798183

00:19:29.220 --> 00:19:30.600 we add in this global

NOTE Confidence: 0.94798183

00:19:30.660 --> 00:19:32.100 image report alignment using the

NOTE Confidence: 0.94798183

00:19:32.100 --> 00:19:33.905 CLIP framework and also local

NOTE Confidence: 0.94798183

00:19:33.905 --> 00:19:35.445 level image report alignment

NOTE Confidence: 0.99283487

00:19:35.744 --> 00:19:36.945 where we learn to match

NOTE Confidence: 0.99283487

00:19:36.945 --> 00:19:38.385 sentence level information in the

NOTE Confidence: 0.99283487

00:19:38.385 --> 00:19:40.065 radiology report with the most

NOTE Confidence: 0.99283487

00:19:40.065 --> 00:19:41.105 relevant image patch in the

NOTE Confidence: 0.99283487

00:19:41.105 --> 00:19:42.565 mammogram and vice versa.

NOTE Confidence: 0.9514508

00:19:43.984 --> 00:19:45.265 So after we perform this

NOTE Confidence: 0.9514508

00:19:45.265 --> 00:19:45.765 pretraining,

NOTE Confidence: 0.941709

00:19:46.385 --> 00:19:47.345 we can then fine tune

NOTE Confidence: 0.941709

00:19:47.345 --> 00:19:48.465 the model to do different

NOTE Confidence: 0.941709

00:19:48.465 --> 00:19:49.950 image analysis tasks including,

NOTE Confidence: 0.9811346

00:19:50.970 --> 00:19:52.170 prediction of the BI RADS

NOTE Confidence: 0.9811346

00:19:52.170 --> 00:19:52.670 category,

NOTE Confidence: 0.97731733

00:19:53.450 --> 00:19:55.530 breast density, and cancer. And

NOTE Confidence: 0.97731733

00:19:55.530 --> 00:19:56.810 we can see our approach

NOTE Confidence: 0.97731733

00:19:56.810 --> 00:19:57.930 in the blue gray on

NOTE Confidence: 0.97731733

00:19:57.930 --> 00:19:58.730 the very right of each

NOTE Confidence: 0.97731733

00:19:58.730 --> 00:20:00.090 of these plots, performs the

NOTE Confidence: 0.97731733

00:20:00.090 --> 00:20:00.890 best for each of these

NOTE Confidence: 0.97731733

00:20:00.890 --> 00:20:02.030 model learning scenarios.

NOTE Confidence: 0.97274005

00:20:03.984 --> 00:20:05.924 Finally, we leverage the geometry

NOTE Confidence: 0.97274005

00:20:05.984 --> 00:20:07.525 of the multi view imaging

NOTE Confidence: 0.97274005

00:20:07.665 --> 00:20:08.865 process to learn how to

NOTE Confidence: 0.97274005

00:20:08.865 --> 00:20:10.385 align local image features before

NOTE Confidence: 0.97274005

00:20:10.385 --> 00:20:11.184 we're just looking at kind

NOTE Confidence: 0.97274005

00:20:11.184 --> 00:20:12.544 of the global image. And

NOTE Confidence: 0.97274005

00:20:12.544 --> 00:20:13.744 we can see here, at

NOTE Confidence: 0.97274005

00:20:13.744 --> 00:20:15.184 the bottom that red dot,

NOTE Confidence: 0.97274005

00:20:15.184 --> 00:20:16.865 this, small region of interest

NOTE Confidence: 0.97274005

00:20:16.865 --> 00:20:18.929 actually corresponds to multiple locations

NOTE Confidence: 0.97274005

00:20:18.929 --> 00:20:20.049 in the blue tube on

NOTE Confidence: 0.97274005

00:20:20.049 --> 00:20:20.710 the left,

NOTE Confidence: 0.94080365

00:20:22.049 --> 00:20:23.409 that, goes through the same

NOTE Confidence: 0.94080365

00:20:23.409 --> 00:20:24.690 slice on the breast. And

NOTE Confidence: 0.94080365

00:20:24.690 --> 00:20:25.909 so we use this geometric

NOTE Confidence: 0.94080365

00:20:25.970 --> 00:20:27.409 constraint to perform this contrast

NOTE Confidence: 0.94080365

00:20:27.409 --> 00:20:28.850 of pretraining to align each

NOTE Confidence: 0.94080365

00:20:28.850 --> 00:20:29.890 patch in one view with

NOTE Confidence: 0.94080365

00:20:29.890 --> 00:20:31.250 each corresponding slice in the

NOTE Confidence: 0.94080365

00:20:31.250 --> 00:20:32.615 other view. And using this

NOTE Confidence: 0.94080365

00:20:32.615 --> 00:20:34.375 local alignment, we again see

NOTE Confidence: 0.94080365

00:20:34.375 --> 00:20:36.055 improvement in this BI RADS

NOTE Confidence: 0.94080365

00:20:36.055 --> 00:20:36.875 category prediction.

NOTE Confidence: 0.9638802

00:20:38.455 --> 00:20:39.575 So finally, I'm just gonna

NOTE Confidence: 0.9638802

00:20:39.575 --> 00:20:40.695 touch on our breast MRI

NOTE Confidence: 0.9638802

00:20:40.695 --> 00:20:42.055 work, where we're looking to

NOTE Confidence: 0.9638802

00:20:42.055 --> 00:20:43.415 improve the segmentation of tumors

NOTE Confidence: 0.9638802

00:20:43.415 --> 00:20:44.455 with additional knowledge of the

NOTE Confidence: 0.9638802

00:20:44.455 --> 00:20:46.220 imaging process. So here's kind

NOTE Confidence: 0.9638802

00:20:46.220 --> 00:20:47.500 of a standard AI model

NOTE Confidence: 0.9638802

00:20:47.500 --> 00:20:48.859 for segmentation where the image

NOTE Confidence: 0.9638802

00:20:48.859 --> 00:20:49.900 goes into a unit and

NOTE Confidence: 0.9638802

00:20:49.900 --> 00:20:50.780 then we get our prediction

NOTE Confidence: 0.9638802

00:20:50.780 --> 00:20:52.320 for our tumor mask.

NOTE Confidence: 0.9731364

00:20:52.940 --> 00:20:53.820 But in our approach, we're

NOTE Confidence: 0.9731364

00:20:53.820 --> 00:20:55.100 going to incorporate the timing

NOTE Confidence: 0.9731364

00:20:55.100 --> 00:20:56.720 of these contrast enhanced MRI

NOTE Confidence: 0.9731364

00:20:56.940 --> 00:20:58.480 to modulate the model parameters

NOTE Confidence: 0.9731364

00:20:58.540 --> 00:20:59.655 and we saw a nice

NOTE Confidence: 0.9731364

00:21:00.055 --> 00:21:01.655 increase in our early results

NOTE Confidence: 0.9731364

00:21:01.655 --> 00:21:03.035 in the segmentation performance.

NOTE Confidence: 0.9794999

00:21:04.135 --> 00:21:05.095 So to conclude, I hope

NOTE Confidence: 0.9794999

00:21:05.095 --> 00:21:05.895 I've given you all an

NOTE Confidence: 0.9794999

00:21:05.895 --> 00:21:07.175 idea of how modern AI

NOTE Confidence: 0.9794999

00:21:07.175 --> 00:21:09.015 approaches can help, enhance breast

NOTE Confidence: 0.9794999

00:21:09.015 --> 00:21:10.055 image analysis. And if you

NOTE Confidence: 0.9794999

00:21:10.055 --> 00:21:11.512 have any ideas on how

NOTE Confidence: 0.9794999

00:21:11.512 --> 00:21:12.472 this might apply to your

NOTE Confidence: 0.9794999

00:21:12.472 --> 00:21:13.912 data or some specific task,

NOTE Confidence: 0.9794999

00:21:13.912 --> 00:21:14.952 I'd be very happy to

NOTE Confidence: 0.9794999

00:21:14.952 --> 00:21:16.412 discuss further. Thank you.