WEBVTT

NOTE duration:"00:14:53"

NOTE recognizability:0.798

NOTE language:en-us

NOTE Confidence: 0.861588008571429

00:00:13.390 --> 00:00:15.350 Welcome back, this session is

NOTE Confidence: 0.861588008571429

00:00:15.350 --> 00:00:18.370 being recorded. Thank you.

NOTE Confidence: 0.861588008571429

00:00:18.370 --> 00:00:20.170 So I'd like to introduce another

NOTE Confidence: 0.861588008571429

00:00:20.170 --> 00:00:21.970 colleague of mine from radiology.

NOTE Confidence: 0.861588008571429

00:00:21.970 --> 00:00:23.368 Our next speaker is Julia Shapiro,

NOTE Confidence: 0.861588008571429

00:00:23.370 --> 00:00:24.889 who is an assistant professor in the

NOTE Confidence: 0.861588008571429

00:00:24.889 --> 00:00:26.762 department, and he is going to talk to

NOTE Confidence: 0.861588008571429

00:00:26.762 --> 00:00:29.109 us about big data and AI in Hepatology,

NOTE Confidence: 0.861588008571429

00:00:29.110 --> 00:00:33.570 Julius. Thank you very much and

NOTE Confidence: 0.861588008571429

00:00:33.570 --> 00:00:35.920 just share my screen and go.

NOTE Confidence: 0.730712657083333

00:00:39.270 --> 00:00:41.055 I'm OK never going to see my

NOTE Confidence: 0.730712657083333

00:00:41.055 --> 00:00:42.579 slides and hear me properly.

NOTE Confidence: 0.770680875

00:00:43.440 --> 00:00:44.760 That's great, all right?

NOTE Confidence: 0.834404509

00:00:44.850 --> 00:00:46.602 Well, thank you very much to

NOTE Confidence: 0.834404509

00:00:46.602 --> 00:00:47.770 everyone for organizing that,

NOTE Confidence: 0.834404509

00:00:47.770 --> 00:00:50.185 and I'm very proud to be speaking

NOTE Confidence: 0.834404509

00:00:50.185 --> 00:00:52.972 here at the 75th anniversary of

NOTE Confidence: 0.834404509

00:00:52.972 --> 00:00:55.204 the Yale Hepatology Department.

NOTE Confidence: 0.834404509

00:00:55.210 --> 00:00:56.866 And my topic is to speak about big

NOTE Confidence: 0.834404509

00:00:56.866 --> 00:00:58.470 data in the eye and hepatology.

NOTE Confidence: 0.834404509

00:00:58.470 --> 00:01:01.215 And I want to talk about future of clinical

NOTE Confidence: 0.834404509

00:01:01.215 --> 00:01:03.345 integration of these tools and liver cancer.

NOTE Confidence: 0.834404509

00:01:03.350 --> 00:01:05.550 And at first I would like to say

NOTE Confidence: 0.834404509

00:01:05.550 --> 00:01:08.038 that it behooves us to think about.

NOTE Confidence: 0.834404509

00:01:08.040 --> 00:01:10.840 Medicine and hepatology in particular,

NOTE Confidence: 0.834404509

00:01:10.840 --> 00:01:13.060 uh, from a perspective of data,

NOTE Confidence: 0.834404509

00:01:13.060 --> 00:01:15.949 so this was a projection of Stanford

NOTE Confidence: 0.834404509

00:01:15.949 --> 00:01:17.794 medicine that focused on predicting

NOTE Confidence: 0.834404509

00:01:17.794 --> 00:01:19.625 the growth in healthcare data

NOTE Confidence: 0.834404509

00:01:19.625 --> 00:01:21.545 between the years 2013 and 2020,

NOTE Confidence: 0.834404509

00:01:21.545 --> 00:01:23.960 and they predicted the 15 fold growth,

NOTE Confidence: 0.834404509

00:01:23.960 --> 00:01:26.104 and in fact they were off because in

NOTE Confidence: 0.834404509

00:01:26.104 --> 00:01:28.099 reality the growth was up to 20 fold.

NOTE Confidence: 0.834404509

00:01:28.100 --> 00:01:30.036 In terms of the amount of data that

NOTE Confidence: 0.834404509

00:01:30.036 --> 00:01:32.019 we now have to deal with and on,

NOTE Confidence: 0.834404509

00:01:32.020 --> 00:01:33.922 the right is a typical characteristics

NOTE Confidence: 0.834404509

00:01:33.922 --> 00:01:36.312 of in a large cohort of patients

NOTE Confidence: 0.834404509

00:01:36.312 --> 00:01:38.067 that we once published and.

NOTE Confidence: 0.834404509

00:01:38.070 --> 00:01:39.905 The Journal of Clinical Gastroenterology

NOTE Confidence: 0.834404509

00:01:39.905 --> 00:01:41.682 and Hepatology in 2017 and the

NOTE Confidence: 0.834404509

00:01:41.682 --> 00:01:43.026 table is very confusing and offers

NOTE Confidence: 0.834404509

00:01:43.026 --> 00:01:44.170 a lot of information,

NOTE Confidence: 0.834404509

00:01:44.170 --> 00:01:46.245 so primarily the cancer care

NOTE Confidence: 0.834404509

00:01:46.245 --> 00:01:48.320 can be a data problem,

NOTE Confidence: 0.834404509

00:01:48.320 --> 00:01:50.312 so we do have challenges in modern imaging

NOTE Confidence: 0.834404509

00:01:50.312 --> 00:01:51.866 and intervention that we need to address,

NOTE Confidence: 0.834404509

00:01:51.870 --> 00:01:53.676 and we've been thinking about this

NOTE Confidence: 0.834404509

00:01:53.676 --> 00:01:55.357 issue together with our biomedical

NOTE Confidence: 0.834404509

00:01:55.357 --> 00:01:57.462 engineers and partners in the

NOTE Confidence: 0.834404509

00:01:57.462 --> 00:01:58.725 biomedical engineering sciences,

NOTE Confidence: 0.834404509

00:01:58.730 --> 00:02:01.186 and we have proposed a couple of solutions,

NOTE Confidence: 0.834404509

00:02:01.190 --> 00:02:04.601 so I'd like to talk a little bit about

NOTE Confidence: 0.834404509

00:02:04.601 --> 00:02:08.150 HCC as a data problem so HCC patients.

NOTE Confidence: 0.834404509

00:02:08.150 --> 00:02:10.075 To undergo a multi modality

NOTE Confidence: 0.834404509

00:02:10.075 --> 00:02:11.615 imaging and patient journey,

NOTE Confidence: 0.834404509

00:02:11.620 --> 00:02:13.490 we started with ultrasound screening

NOTE Confidence: 0.834404509

00:02:13.490 --> 00:02:15.842 and then we acquire multiple sessions

NOTE Confidence: 0.834404509

00:02:15.842 --> 00:02:17.502 of multiparametric imaging along

NOTE Confidence: 0.834404509

00:02:17.502 --> 00:02:19.577 the journey of both diagnosis,

NOTE Confidence: 0.834404509

00:02:19.580 --> 00:02:21.920 local regional therapy and systemic therapy,

NOTE Confidence: 0.834404509

00:02:21.920 --> 00:02:23.915 as well as multiple follow-up Mris and

NOTE Confidence: 0.834404509

00:02:23.915 --> 00:02:25.980 every time we do acquire this data,

NOTE Confidence: 0.834404509

00:02:25.980 --> 00:02:28.412 we do get a lot of different parameters

NOTE Confidence: 0.834404509

00:02:28.412 --> 00:02:31.099 that we include into our consideration,

NOTE Confidence: 0.834404509

00:02:31.100 --> 00:02:33.011 yet they are not very well integrated

NOTE Confidence: 0.834404509

00:02:33.011 --> 00:02:34.601 into both the diagnostic therapeutic

NOTE Confidence: 0.834404509

00:02:34.601 --> 00:02:37.107 algorithm but also not very much utilized

NOTE Confidence: 0.834404509

00:02:37.107 --> 00:02:39.395 in terms of how we see those patients.

NOTE Confidence: 0.834404509

00:02:39.400 --> 00:02:42.286 Along the evolving guidelines for therapy.

NOTE Confidence: 0.834404509

00:02:42.290 --> 00:02:44.803 So here are the guidelines that exist

NOTE Confidence: 0.834404509

00:02:44.803 --> 00:02:46.997 for the diagnosis of HCC and Jeff.

NOTE Confidence: 0.834404509

00:02:47.000 --> 00:02:48.650 Wonder have already spoke about Laura's,

NOTE Confidence: 0.834404509

00:02:48.650 --> 00:02:50.243 but I want to say that if there is

NOTE Confidence: 0.834404509

00:02:50.243 --> 00:02:51.931 25 of something across the globe

NOTE Confidence: 0.834404509

00:02:51.931 --> 00:02:53.391 then probably the conclusion is

NOTE Confidence: 0.834404509

00:02:53.441 --> 00:02:55.065 that none of them are really good.

NOTE Confidence: 0.834404509

00:02:55.070 --> 00:02:57.728 So in reality they are unclear,

NOTE Confidence: 0.834404509

00:02:57.730 --> 00:02:59.294 varying and inconsistent definitions

NOTE Confidence: 0.834404509

00:02:59.294 --> 00:03:01.249 of imaging features of HCC.

NOTE Confidence: 0.834404509

00:03:01.250 --> 00:03:03.278 Most references for all guidelines are

NOTE Confidence: 0.834404509

00:03:03.278 --> 00:03:04.630 essentially based on retrospective

NOTE Confidence: 0.834404509

00:03:04.683 --> 00:03:06.435 data and more importantly varying or

NOTE Confidence: 0.834404509

00:03:06.435 --> 00:03:07.995 contradicting or simply no recommendations

NOTE Confidence: 0.834404509

00:03:07.995 --> 00:03:10.389 exist for the assessment of tumor response.

NOTE Confidence: 0.834404509

00:03:10.390 --> 00:03:13.309 You look regional and now also systemic

NOTE Confidence: 0.834404509

00:03:13.309 --> 00:03:16.280 therapy has more agents come into play.

NOTE Confidence: 0.834404509

00:03:16.280 --> 00:03:18.640 We do have a variety of different local

NOTE Confidence: 0.834404509

00:03:18.640 --> 00:03:20.220 regional therapy options and David

NOTE Confidence: 0.834404509

00:03:20.220 --> 00:03:22.397 Meadow have already described some of it.

NOTE Confidence: 0.834404509

00:03:22.400 --> 00:03:24.728 We do have a variety of

NOTE Confidence: 0.834404509

00:03:24.728 --> 00:03:26.228 possibilities to cook, boil,

NOTE Confidence: 0.834404509

00:03:26.228 --> 00:03:28.196 freeze and electrocute the same tumor,

NOTE Confidence: 0.834404509

00:03:28.200 --> 00:03:30.738 and that is essentially dealer's choice,

NOTE Confidence: 0.834404509

00:03:30.740 --> 00:03:32.360 not really based on data.

NOTE Confidence: 0.800126886666666

00:03:32.360 --> 00:03:34.607 The same thing is true for local

NOTE Confidence: 0.800126886666666

00:03:34.607 --> 00:03:36.299 regional therapy via the artery.

NOTE Confidence: 0.800126886666666

00:03:36.300 --> 00:03:38.836 We do have the flavor of conventional taste.

NOTE Confidence: 0.800126886666666

00:03:38.840 --> 00:03:39.660 We do have the depth

NOTE Confidence: 0.800126886666666

00:03:39.660 --> 00:03:40.730 taste and we do have wine.

NOTE Confidence: 0.800126886666666

00:03:40.730 --> 00:03:43.148 Sandy, so very similar therapies with

NOTE Confidence: 0.800126886666666

00:03:43.148 --> 00:03:45.131 slightly different mechanisms of action

NOTE Confidence: 0.800126886666666

00:03:45.131 --> 00:03:47.308 and the data around them sometimes is

NOTE Confidence: 0.800126886666666

00:03:47.308 --> 00:03:50.268 not clear as to what to support for

NOTE Confidence: 0.800126886666666

00:03:50.268 --> 00:03:51.788 which particular individualized patient,

NOTE Confidence: 0.800126886666666

00:03:51.790 --> 00:03:54.214 and now a much bigger challenge are the

NOTE Confidence: 0.800126886666666

00:03:54.214 --> 00:03:56.178 newly introduced systemic therapy agents,

NOTE Confidence: 0.800126886666666

00:03:56.180 --> 00:03:57.554 of which just a few years

NOTE Confidence: 0.800126886666666

00:03:57.554 --> 00:03:58.740 ago there was only one,

NOTE Confidence: 0.800126886666666

00:03:58.740 --> 00:04:00.574 and now we're looking at a large

NOTE Confidence: 0.800126886666666

00:04:00.574 --> 00:04:02.479 combination first and second line therapies,

NOTE Confidence: 0.800126886666666

00:04:02.480 --> 00:04:04.755 all with a variety of different mechanisms,

NOTE Confidence: 0.800126886666666

00:04:04.760 --> 00:04:07.077 and all these are causing different imaging

NOTE Confidence: 0.800126886666666

00:04:07.077 --> 00:04:08.873 appearances of humor response and the

NOTE Confidence: 0.800126886666666

00:04:08.873 --> 00:04:10.980 same thing is true with for all these.

NOTE Confidence: 0.800126886666666

00:04:10.980 --> 00:04:12.708 Regions there imaging challenges.

NOTE Confidence: 0.800126886666666

00:04:12.708 --> 00:04:15.300 Therefore we need to think about

NOTE Confidence: 0.800126886666666

00:04:15.370 --> 00:04:17.332 how to transform the burden into

NOTE Confidence: 0.800126886666666

00:04:17.332 --> 00:04:19.040 value of all this data.

NOTE Confidence: 0.800126886666666

00:04:19.040 --> 00:04:19.824 On the one hand,

NOTE Confidence: 0.800126886666666

00:04:19.824 --> 00:04:21.856 we have the data that it's coming to us

NOTE Confidence: 0.800126886666666

00:04:21.856 --> 00:04:23.470 from the electronic health care records,

NOTE Confidence: 0.800126886666666

00:04:23.470 --> 00:04:24.451 the genomic sequencing,

NOTE Confidence: 0.800126886666666

00:04:24.451 --> 00:04:26.740 and we heard a lot of information

NOTE Confidence: 0.800126886666666

00:04:26.798 --> 00:04:28.842 about that and we now have novel

NOTE Confidence: 0.800126886666666

00:04:28.842 --> 00:04:30.676 tools like natural language processing

NOTE Confidence: 0.800126886666666

00:04:30.676 --> 00:04:32.017 and image analysis,

NOTE Confidence: 0.800126886666666

00:04:32.020 --> 00:04:33.775 and they need computational power

NOTE Confidence: 0.800126886666666

00:04:33.775 --> 00:04:34.828 at low cost.

NOTE Confidence: 0.800126886666666

00:04:34.830 --> 00:04:36.307 So then there is this term that

NOTE Confidence: 0.800126886666666

00:04:36.307 --> 00:04:37.256 is called artificial intelligence

NOTE Confidence: 0.800126886666666

00:04:37.256 --> 00:04:38.360 that some people use.

NOTE Confidence: 0.800126886666666

00:04:38.360 --> 00:04:39.755 Essentially biomedical engineers

NOTE Confidence: 0.800126886666666

00:04:39.755 --> 00:04:41.150 speak of machine.

NOTE Confidence: 0.800126886666666

00:04:41.150 --> 00:04:43.366 Learning technology that recognizes

NOTE Confidence: 0.800126886666666

00:04:43.366 --> 00:04:47.396 trends and data and can evaluate patterns

NOTE Confidence: 0.800126886666666

00:04:47.396 --> 00:04:50.516 based on simply algorithmic learning.

NOTE Confidence: 0.800126886666666

00:04:50.520 --> 00:04:54.377 And then we have this subgroup of.

NOTE Confidence: 0.800126886666666

00:04:54.380 --> 00:04:55.780 That is called deep learning,

NOTE Confidence: 0.800126886666666

00:04:55.780 --> 00:04:58.084 which is based primarily on neural

NOTE Confidence: 0.800126886666666

00:04:58.084 --> 00:05:00.464 networks that adopt based on data

NOTE Confidence: 0.800126886666666

00:05:00.464 --> 00:05:02.504 without pre segmentation and without

NOTE Confidence: 0.800126886666666

00:05:02.504 --> 00:05:04.766 data specific data annotation in some

NOTE Confidence: 0.800126886666666

00:05:04.766 --> 00:05:07.540 cases and all these things can result in.

NOTE Confidence: 0.800126886666666

00:05:07.540 --> 00:05:09.820 Hopefully workflow efficiency increases

NOTE Confidence: 0.800126886666666

00:05:09.820 --> 00:05:12.100 with improved diagnostic accuracy

NOTE Confidence: 0.800126886666666

00:05:12.100 --> 00:05:14.918 and they can enable us to probably

NOTE Confidence: 0.800126886666666

00:05:14.918 --> 00:05:16.663 provide us with different practice

NOTE Confidence: 0.800126886666666

00:05:16.663 --> 00:05:18.052 of predictive recommendations that

NOTE Confidence: 0.800126886666666

00:05:18.052 --> 00:05:19.532 are better for precision medicine

NOTE Confidence: 0.800126886666666

00:05:19.532 --> 00:05:20.420 and image guidance.

NOTE Confidence: 0.800126886666666

00:05:20.420 --> 00:05:21.896 But is that all really true?

NOTE Confidence: 0.800126886666666

00:05:21.900 --> 00:05:24.447 And it can that really all be applied well?

NOTE Confidence: 0.800126886666666

00:05:24.450 --> 00:05:25.262 I mean,

NOTE Confidence: 0.800126886666666

00:05:25.262 --> 00:05:27.698 we've started this this road and

NOTE Confidence: 0.800126886666666

00:05:27.700 --> 00:05:29.530 essentially mapped out a journey

NOTE Confidence: 0.800126886666666

00:05:29.530 --> 00:05:31.360 that reaches from diagnosis towards

NOTE Confidence: 0.800126886666666

00:05:31.419 --> 00:05:32.679 therapeutic decision making

NOTE Confidence: 0.800126886666666

00:05:32.679 --> 00:05:34.359 interprocedural guidance and follow

NOTE Confidence: 0.800126886666666

00:05:34.359 --> 00:05:36.727 up imaging and we have worked

NOTE Confidence: 0.800126886666666

00:05:36.727 --> 00:05:38.127 tirelessly with in partnership

NOTE Confidence: 0.800126886666666

00:05:38.127 --> 00:05:40.116 with our biomedical engineers and

NOTE Confidence: 0.800126886666666

00:05:40.116 --> 00:05:41.988 computer scientists on focusing

NOTE Confidence: 0.800126886666666

00:05:41.988 --> 00:05:44.422 on automation of diagnosis and

NOTE Confidence: 0.800126886666666

00:05:44.422 --> 00:05:46.398 creating novel imaging biomarkers.

NOTE Confidence: 0.800126886666666

00:05:46.400 --> 00:05:47.920 Focusing on outcome prediction

NOTE Confidence: 0.800126886666666

00:05:47.920 --> 00:05:49.440 and therapeutic decision making.

NOTE Confidence: 0.800126886666666

00:05:49.440 --> 00:05:51.925 Following up for target coverage in the

NOTE Confidence: 0.800126886666666

00:05:51.925 --> 00:05:54.460 procedure room and then on tumor response.

NOTE Confidence: 0.800126886666666

00:05:54.460 --> 00:05:56.400 Assessment and the decision

NOTE Confidence: 0.800126886666666

00:05:56.400 --> 00:05:57.370 for reintervention.

NOTE Confidence: 0.800126886666666

00:05:57.370 --> 00:05:59.512 Now the vision for all this applied

NOTE Confidence: 0.800126886666666

00:05:59.512 --> 00:06:01.553 to the multi parametric data that

NOTE Confidence: 0.800126886666666

00:06:01.553 --> 00:06:03.308 is both clinical and imaging

NOTE Confidence: 0.800126886666666

00:06:03.308 --> 00:06:05.610 is to achieve fully automated,

NOTE Confidence: 0.800126886666666

00:06:05.610 --> 00:06:06.083 fast,

NOTE Confidence: 0.800126886666666

00:06:06.083 --> 00:06:08.448 reproducible and reliable tumor detection.

NOTE Confidence: 0.800126886666666

00:06:08.450 --> 00:06:09.442 Tissue characterization,

NOTE Confidence: 0.800126886666666

00:06:09.442 --> 00:06:11.426 clinical decision support system,

NOTE Confidence: 0.800126886666666

00:06:11.430 --> 00:06:13.020 ultimately providing a tumor board

NOTE Confidence: 0.800126886666666

00:06:13.020 --> 00:06:15.223 with a probability map that tells you

NOTE Confidence: 0.800126886666666

00:06:15.223 --> 00:06:17.162 everything you want to know about this

NOTE Confidence: 0.800126886666666

00:06:17.162 --> 00:06:19.086 tumor and the future decision making.

NOTE Confidence: 0.800126886666666

00:06:19.090 --> 00:06:20.686 Some of the steps in the nascent

NOTE Confidence: 0.800126886666666

00:06:20.686 --> 00:06:21.906 steps that we've published are

NOTE Confidence: 0.800126886666666

00:06:21.906 --> 00:06:23.600 focusing again on live rats and one

NOTE Confidence: 0.800126886666666

00:06:23.600 --> 00:06:25.476 of the things that we focused on was.

NOTE Confidence: 0.800126886666666

00:06:25.480 --> 00:06:28.540 Automation of tumor detection and we

NOTE Confidence: 0.82154383375

00:06:28.540 --> 00:06:30.552 published this particular work

NOTE Confidence: 0.82154383375

00:06:30.552 --> 00:06:32.802 in abdominal radiology in 2021,

NOTE Confidence: 0.82154383375

00:06:32.802 --> 00:06:34.658 and the key point here was that was

NOTE Confidence: 0.82154383375

00:06:34.658 --> 00:06:36.239 that the convolutional neural network

NOTE Confidence: 0.82154383375

00:06:36.239 --> 00:06:38.177 has a high level of performance

NOTE Confidence: 0.82154383375

00:06:38.235 --> 00:06:39.372 and automatically delineating

NOTE Confidence: 0.82154383375

00:06:39.372 --> 00:06:41.267 liver and focal liver lesions,

NOTE Confidence: 0.82154383375

00:06:41.270 --> 00:06:44.532 and it can flag cases with poor

NOTE Confidence: 0.82154383375

00:06:44.532 --> 00:06:46.740 performance and therefore functioning

NOTE Confidence: 0.82154383375

00:06:46.740 --> 00:06:50.220 effectively as an internal quality control.

NOTE Confidence: 0.82154383375

00:06:50.220 --> 00:06:52.480 Another paper that we published

NOTE Confidence: 0.82154383375

00:06:52.480 --> 00:06:54.510 focused on the automation of

NOTE Confidence: 0.82154383375

00:06:54.510 --> 00:06:55.728 diagnosis and classification.

NOTE Confidence: 0.82154383375

00:06:55.730 --> 00:06:57.706 This was a work done with a lot

NOTE Confidence: 0.82154383375

00:06:57.706 --> 00:06:59.630 of partners across the board and

NOTE Confidence: 0.82154383375

00:06:59.630 --> 00:07:01.880 here we demonstrated the deep

NOTE Confidence: 0.82154383375

00:07:01.880 --> 00:07:04.634 learning is able to really classify

NOTE Confidence: 0.82154383375

00:07:04.634 --> 00:07:07.331 a variety of different lesions in

NOTE Confidence: 0.82154383375

00:07:07.331 --> 00:07:09.197 a millisecond of time per lesion,

NOTE Confidence: 0.82154383375

00:07:09.200 --> 00:07:11.846 and this could theoretically help us

NOTE Confidence: 0.82154383375

00:07:11.846 --> 00:07:14.360 make clinical workflows more efficient.

NOTE Confidence: 0.82154383375

00:07:14.360 --> 00:07:16.215 And here we demonstrated and

NOTE Confidence: 0.82154383375

00:07:16.215 --> 00:07:18.070 cross referenced this work with

NOTE Confidence: 0.82154383375

00:07:18.137 --> 00:07:20.093 two experienced body trained

NOTE Confidence: 0.82154383375

00:07:20.093 --> 00:07:22.049 radiologists and demonstrated that

NOTE Confidence: 0.82154383375

00:07:22.049 --> 00:07:24.470 the sensitivity and specificity of

NOTE Confidence: 0.82154383375

00:07:24.470 --> 00:07:26.310 the convolutional neural network.

NOTE Confidence: 0.82154383375

00:07:26.310 --> 00:07:28.932 Based on algorithm was essentially higher

NOTE Confidence: 0.82154383375

00:07:28.932 --> 00:07:31.769 than both radiologists for recognizing a

NOTE Confidence: 0.82154383375

00:07:31.769 --> 00:07:34.309 benign from malignant and specifically

NOTE Confidence: 0.82154383375

00:07:34.309 --> 00:07:36.420 diagnosing various liberal lesions.

NOTE Confidence: 0.82154383375

00:07:36.420 --> 00:07:38.796 Then we also focused on Iraq,

NOTE Confidence: 0.82154383375

00:07:38.800 --> 00:07:40.144 path validation and classification.

NOTE Confidence: 0.82154383375

00:07:40.144 --> 00:07:42.490 That's a core issue of the work.

NOTE Confidence: 0.82154383375

00:07:42.490 --> 00:07:42.897 Here.

NOTE Confidence: 0.82154383375

00:07:42.897 --> 00:07:45.339 We demonstrated the deep learning assisted

NOTE Confidence: 0.82154383375

00:07:45.339 --> 00:07:46.960 differentiation of pathologically proven,

NOTE Confidence: 0.82154383375

00:07:46.960 --> 00:07:48.960 atypical and typical pedicellata

NOTE Confidence: 0.82154383375

00:07:48.960 --> 00:07:51.960 carcinoma lesions is possible on MRI,

NOTE Confidence: 0.82154383375

00:07:51.960 --> 00:07:53.660 and we demonstrated that

NOTE Confidence: 0.82154383375

00:07:53.660 --> 00:07:55.360 even Lara's 4 lesions,

NOTE Confidence: 0.82154383375

00:07:55.360 --> 00:07:57.439 namely those that cannot be diagnosed with.

NOTE Confidence: 0.82154383375

00:07:57.440 --> 00:07:59.480 Simple imaging criteria according to

NOTE Confidence: 0.82154383375

00:07:59.480 --> 00:08:01.520 layouts can be ultimately diagnosed

NOTE Confidence: 0.82154383375

00:08:01.579 --> 00:08:03.785 with the help of machine learning and

NOTE Confidence: 0.82154383375

00:08:03.785 --> 00:08:05.795 that can potentially help us redirect

NOTE Confidence: 0.82154383375

00:08:05.795 --> 00:08:08.139 the need for biopsy and another layer

NOTE Confidence: 0.82154383375

00:08:08.139 --> 00:08:10.802 of work that we have added in another

NOTE Confidence: 0.82154383375

00:08:10.802 --> 00:08:12.890 piece of information is very early

NOTE Confidence: 0.82154383375

00:08:12.890 --> 00:08:15.558 attempt to introduce explain ability,

NOTE Confidence: 0.82154383375

00:08:15.558 --> 00:08:17.605 namely to take artificial intelligence

NOTE Confidence: 0.82154383375

00:08:17.605 --> 00:08:19.921 as we call it out of the black box

NOTE Confidence: 0.82154383375

00:08:19.921 --> 00:08:21.306 and to provide it interpretable.

NOTE Confidence: 0.82154383375

00:08:21.310 --> 00:08:23.218 Deep learning system that explains why

NOTE Confidence: 0.82154383375

00:08:23.218 --> 00:08:25.954 it came to a specific decision and that

NOTE Confidence: 0.82154383375

00:08:25.954 --> 00:08:28.430 I think is very important and that.

NOTE Confidence: 0.82154383375

00:08:28.430 --> 00:08:30.100 Point will remain with us.

NOTE Confidence: 0.82154383375

00:08:30.100 --> 00:08:32.032 It's an unmet need to explain the

NOTE Confidence: 0.82154383375

00:08:32.032 --> 00:08:33.525 decision making of the machine

NOTE Confidence: 0.82154383375

00:08:33.525 --> 00:08:35.040 learning algorithm and how could

NOTE Confidence: 0.82154383375

00:08:35.040 --> 00:08:37.119 this work in a clinical work file.

NOTE Confidence: 0.82154383375

00:08:37.120 --> 00:08:37.513 Well,

NOTE Confidence: 0.82154383375

00:08:37.513 --> 00:08:39.478 in reality radiologists could connect

NOTE Confidence: 0.82154383375

00:08:39.478 --> 00:08:42.036 to the clinical pack system via VPN

NOTE Confidence: 0.82154383375

00:08:42.036 --> 00:08:43.982 and connect it to a research server

NOTE Confidence: 0.82154383375

00:08:43.982 --> 00:08:46.169 which we have here in collaboration

NOTE Confidence: 0.82154383375

00:08:46.169 --> 00:08:47.645 with Visage Radiologists would

NOTE Confidence: 0.82154383375

00:08:47.645 --> 00:08:49.535 then open a multiparametric MRI

NOTE Confidence: 0.82154383375

00:08:49.535 --> 00:08:51.355 and initiate the auto automated

NOTE Confidence: 0.82154383375

00:08:51.355 --> 00:08:53.096 liver tumor segmentation as we

NOTE Confidence: 0.82154383375

00:08:53.096 --> 00:08:54.816 demonstrated that it's possible and

NOTE Confidence: 0.82154383375

00:08:54.816 --> 00:08:56.968 with one click classify a lesion as

NOTE Confidence: 0.82154383375

00:08:56.968 --> 00:08:58.669 some malignant or benign and then.

NOTE Confidence: 0.82154383375

00:08:58.670 --> 00:08:59.134 Uh,

NOTE Confidence: 0.82154383375

00:08:59.134 --> 00:09:01.918 the AI would provide a Lawrence

NOTE Confidence: 0.82154383375

00:09:01.918 --> 00:09:03.809 report characterizing this entity

NOTE Confidence: 0.82154383375

00:09:03.809 --> 00:09:05.929 as specific type of lyrics,

NOTE Confidence: 0.82154383375

00:09:05.930 --> 00:09:07.665 and then the radiologists could

NOTE Confidence: 0.82154383375

00:09:07.665 --> 00:09:09.817 decline and accept verbiage of the

NOTE Confidence: 0.82154383375

00:09:09.817 --> 00:09:11.582 report based on specific features

NOTE Confidence: 0.82154383375

00:09:11.582 --> 00:09:13.646 that are highlighted here and and

NOTE Confidence: 0.82154383375

00:09:13.646 --> 00:09:15.727 colleague of Mine Joe Cavallo was

NOTE Confidence: 0.82154383375

00:09:15.727 --> 00:09:19.309 spearheading this effort with the visage.

NOTE Confidence: 0.82154383375

00:09:19.310 --> 00:09:20.156 But then again,

NOTE Confidence: 0.82154383375

00:09:20.156 --> 00:09:21.848 the next layer of questions that

NOTE Confidence: 0.82154383375

00:09:21.848 --> 00:09:23.920 need to be answered is can neural

NOTE Confidence: 0.82154383375

00:09:23.920 --> 00:09:25.512 networks actually help us predict

NOTE Confidence: 0.82154383375

00:09:25.512 --> 00:09:27.048 response to certain therapy?

NOTE Confidence: 0.82154383375

00:09:27.050 --> 00:09:28.466 And this is something that we

NOTE Confidence: 0.82154383375

00:09:28.466 --> 00:09:29.930 thought about and we tested it.

NOTE Confidence: 0.82154383375

00:09:29.930 --> 00:09:32.514 Early on in 2017 and a small cohort

NOTE Confidence: 0.82154383375

00:09:32.514 --> 00:09:34.593 of patients that underwent the

NOTE Confidence: 0.82154383375

00:09:34.593 --> 00:09:36.868 local regional therapy with taste,

NOTE Confidence: 0.673654571428571

00:09:36.870 --> 00:09:39.208 we put in to the data set.

NOTE Confidence: 0.673654571428571

00:09:39.210 --> 00:09:41.532 Both age and gender other tumor

NOTE Confidence: 0.673654571428571

00:09:41.532 --> 00:09:43.684 characteristics as well as imaging

NOTE Confidence: 0.673654571428571

00:09:43.684 --> 00:09:46.354 appearances and ran a relatively

NOTE Confidence: 0.673654571428571

00:09:46.354 --> 00:09:48.021 straightforward machine learning algorithm

NOTE Confidence: 0.673654571428571

00:09:48.021 --> 00:09:50.283 and defined taste response versus taste.

NOTE Confidence: 0.673654571428571

00:09:50.290 --> 00:09:52.540 Non response as the output

NOTE Confidence: 0.673654571428571

00:09:52.540 --> 00:09:54.082 classifier and ultimately with the

NOTE Confidence: 0.673654571428571

00:09:54.082 --> 00:09:55.720 goal to have a good predictor.

NOTE Confidence: 0.673654571428571

00:09:55.720 --> 00:09:58.318 And we published that model that

NOTE Confidence: 0.673654571428571

00:09:58.318 --> 00:10:00.050 focused on logistic regression.

NOTE Confidence: 0.673654571428571

00:10:00.050 --> 00:10:01.755 Random forest in egg PIR

NOTE Confidence: 0.673654571428571

00:10:01.755 --> 00:10:03.460 and we weren't too hopeful,

NOTE Confidence: 0.673654571428571

00:10:03.460 --> 00:10:05.932 although the results were quite good

NOTE Confidence: 0.673654571428571

00:10:05.932 --> 00:10:08.479 in terms of predictability with their

NOTE Confidence: 0.673654571428571

00:10:08.479 --> 00:10:11.013 Roc curve predictability of 78% and accuracy,

NOTE Confidence: 0.673654571428571

00:10:11.013 --> 00:10:12.468 we weren't really too hopeful

NOTE Confidence: 0.673654571428571

00:10:12.468 --> 00:10:14.017 that it's going to take off,

NOTE Confidence: 0.673654571428571

00:10:14.020 --> 00:10:16.130 but above and beyond expectations

NOTE Confidence: 0.673654571428571

00:10:16.130 --> 00:10:18.704 were met with this work being

NOTE Confidence: 0.673654571428571

00:10:18.704 --> 00:10:20.896 cited over 90 times since 2019,

NOTE Confidence: 0.673654571428571

00:10:20.896 --> 00:10:22.552 where it fully appeared on PUB

NOTE Confidence: 0.673654571428571

00:10:22.552 --> 00:10:24.598 Med and that really tells you how

NOTE Confidence: 0.673654571428571

00:10:24.598 --> 00:10:26.326 much this topic is of interest

NOTE Confidence: 0.673654571428571

00:10:26.384 --> 00:10:27.909 right now in liver disease.

NOTE Confidence: 0.673654571428571

00:10:27.910 --> 00:10:30.196 And it is definitely worth investing.

NOTE Confidence: 0.673654571428571

00:10:30.200 --> 00:10:32.864 So how do we see in the future

NOTE Confidence: 0.673654571428571

00:10:32.864 --> 00:10:34.439 the implementation of these

NOTE Confidence: 0.673654571428571

00:10:34.439 --> 00:10:36.529 workflows into the clinical value?

NOTE Confidence: 0.673654571428571

00:10:36.530 --> 00:10:38.770 So right now we have a referring physician,

NOTE Confidence: 0.673654571428571

00:10:38.770 --> 00:10:40.480 the hepatologist here for example,

NOTE Confidence: 0.673654571428571

00:10:40.480 --> 00:10:42.648 who send us a patient for image acquisition

NOTE Confidence: 0.673654571428571

00:10:42.648 --> 00:10:44.129 and discussion on the tumor board.

NOTE Confidence: 0.673654571428571

00:10:44.130 --> 00:10:46.426 And then we meet in the tumor board,

NOTE Confidence: 0.673654571428571

00:10:46.430 --> 00:10:47.594 discussed the patients,

NOTE Confidence: 0.673654571428571

00:10:47.594 --> 00:10:49.146 need clinical and nonclinical,

NOTE Confidence: 0.673654571428571

00:10:49.150 --> 00:10:50.126 and report.

NOTE Confidence: 0.673654571428571

00:10:50.126 --> 00:10:51.590 Read the report,

NOTE Confidence: 0.673654571428571

00:10:51.590 --> 00:10:53.330 demonstrate the images and make the

NOTE Confidence: 0.673654571428571

00:10:53.330 --> 00:10:55.169 decision on the intervention in the future.

NOTE Confidence: 0.673654571428571

00:10:55.170 --> 00:10:57.730 I think of the vision can be to have the

NOTE Confidence: 0.673654571428571

00:10:57.803 --> 00:11:00.498 clinical information be fed into an image.

NOTE Confidence: 0.673654571428571

00:11:00.500 --> 00:11:01.960 Post processing algorithm that

NOTE Confidence: 0.673654571428571

00:11:01.960 --> 00:11:03.420 uses those developed machine

NOTE Confidence: 0.673654571428571

00:11:03.420 --> 00:11:05.417 learning tools to provide those

NOTE Confidence: 0.673654571428571

00:11:05.417 --> 00:11:06.626 quantitative imaging biomarkers.

NOTE Confidence: 0.673654571428571

00:11:06.630 --> 00:11:08.710 It's a decision support

NOTE Confidence: 0.673654571428571

00:11:08.710 --> 00:11:10.790 tool for radiologists and,

NOTE Confidence: 0.673654571428571

00:11:10.790 --> 00:11:12.850 quite frankly also pathologists

NOTE Confidence: 0.673654571428571

00:11:12.850 --> 00:11:15.374 and clinicians to really to really

NOTE Confidence: 0.673654571428571

00:11:15.374 --> 00:11:16.766 help us make the right decision

NOTE Confidence: 0.673654571428571

00:11:16.766 --> 00:11:18.689 for a specific patient in a

NOTE Confidence: 0.673654571428571

00:11:18.689 --> 00:11:19.745 more individualized fashion,

NOTE Confidence: 0.673654571428571

00:11:19.750 --> 00:11:22.134 and that is really true also for the

NOTE Confidence: 0.673654571428571

00:11:22.134 --> 00:11:24.696 variety of information that we now have

NOTE Confidence: 0.673654571428571

00:11:24.696 --> 00:11:27.110 through the updated VCP staging system.

NOTE Confidence: 0.673654571428571

00:11:27.110 --> 00:11:27.487 Now,

NOTE Confidence: 0.673654571428571

00:11:27.487 --> 00:11:29.749 how do you actually go about

NOTE Confidence: 0.673654571428571

00:11:29.749 --> 00:11:30.503 machine learning?

NOTE Confidence: 0.673654571428571

00:11:30.510 --> 00:11:32.958 And I would like to sort of

NOTE Confidence: 0.673654571428571

00:11:32.958 --> 00:11:34.878 draw a couple of conclusions,

NOTE Confidence: 0.673654571428571

00:11:34.880 --> 00:11:36.116 slides and say where we need

NOTE Confidence: 0.673654571428571

00:11:36.116 --> 00:11:38.198 to go so when we talk about the

NOTE Confidence: 0.673654571428571

00:11:38.198 --> 00:11:39.398 application of machine learning

NOTE Confidence: 0.673654571428571

00:11:39.398 --> 00:11:40.890 to clinical and imaging data,

NOTE Confidence: 0.673654571428571

00:11:40.890 --> 00:11:42.365 it's important that AI can't

NOTE Confidence: 0.673654571428571

00:11:42.365 --> 00:11:43.840 solve every problem in medicine.

NOTE Confidence: 0.673654571428571

00:11:43.840 --> 00:11:45.120 Not every investigator has a

NOTE Confidence: 0.673654571428571

00:11:45.120 --> 00:11:46.710 good product or a good idea.

NOTE Confidence: 0.673654571428571

00:11:46.710 --> 00:11:47.774 We cannot create solutions

NOTE Confidence: 0.673654571428571

00:11:47.774 --> 00:11:49.104 in the absence of problems,

NOTE Confidence: 0.673654571428571

00:11:49.110 --> 00:11:50.970 and we also should start with

NOTE Confidence: 0.673654571428571

00:11:50.970 --> 00:11:52.210 simple issues frequently encounter

NOTE Confidence: 0.673654571428571

00:11:52.267 --> 00:11:53.587 pathologies with high incident

NOTE Confidence: 0.673654571428571

00:11:53.587 --> 00:11:55.567 trades rather than very rare finding.

NOTE Confidence: 0.673654571428571

00:11:55.570 --> 00:11:57.490 So HTC is a really good.

NOTE Confidence: 0.673654571428571

00:11:57.490 --> 00:11:59.779 Problem and has a lot of good

NOTE Confidence: 0.673654571428571

00:11:59.779 --> 00:12:00.433 information available,

NOTE Confidence: 0.673654571428571

00:12:00.440 --> 00:12:02.258 so that's a really good prompt to start with,

NOTE Confidence: 0.673654571428571

00:12:02.260 --> 00:12:04.429 and I think that we need to focus on

NOTE Confidence: 0.673654571428571

00:12:04.429 --> 00:12:06.424 the blatant and critical issues in

NOTE Confidence: 0.673654571428571

00:12:06.424 --> 00:12:09.200 HC rather than the latent and aspirational.

NOTE Confidence: 0.673654571428571

00:12:09.200 --> 00:12:11.447 And also I would like to suggest

NOTE Confidence: 0.673654571428571

00:12:11.447 --> 00:12:13.995 that we avoid the black box of

NOTE Confidence: 0.673654571428571

00:12:13.995 --> 00:12:15.880 actually development and value the

NOTE Confidence: 0.673654571428571

00:12:15.880 --> 00:12:18.640 Co development between the clinical.

NOTE Confidence: 0.673654571428571

00:12:18.640 --> 00:12:20.312 Researchers between the physicians

NOTE Confidence: 0.673654571428571

00:12:20.312 --> 00:12:22.402 and the engineers and computer

NOTE Confidence: 0.673654571428571

00:12:22.402 --> 00:12:24.220 scientists in order to bring an

NOTE Confidence: 0.673654571428571

00:12:24.220 --> 00:12:25.905 idea towards a prototype and then

NOTE Confidence: 0.673654571428571

00:12:25.905 --> 00:12:27.305 validate it clinically and then

NOTE Confidence: 0.673654571428571

00:12:27.305 --> 00:12:28.425 come up with a

NOTE Confidence: 0.874401254166667

00:12:28.430 --> 00:12:30.296 product. And this is an iterative

NOTE Confidence: 0.874401254166667

00:12:30.296 --> 00:12:32.489 process and that is very important.

NOTE Confidence: 0.874401254166667

00:12:32.490 --> 00:12:34.639 And ultimately I think it remains to

NOTE Confidence: 0.874401254166667

00:12:34.639 --> 00:12:37.229 be seen how the FDA will handle that.

NOTE Confidence: 0.874401254166667

00:12:37.230 --> 00:12:38.460 I mean, there is a lot

NOTE Confidence: 0.874401254166667

00:12:38.460 --> 00:12:39.280 of conversation going on.

NOTE Confidence: 0.874401254166667

00:12:39.280 --> 00:12:41.205 This is a pipeline that was proposed

NOTE Confidence: 0.874401254166667

00:12:41.205 --> 00:12:43.590 by the FDA in 2019 and there have

NOTE Confidence: 0.874401254166667

00:12:43.590 --> 00:12:45.315 been amendments ever since about

NOTE Confidence: 0.874401254166667

00:12:45.315 --> 00:12:46.895 how a commercially available

NOTE Confidence: 0.874401254166667

00:12:46.895 --> 00:12:48.725 product is going to be distributed.

NOTE Confidence: 0.874401254166667

00:12:48.730 --> 00:12:51.114 And used in a real world and the

NOTE Confidence: 0.874401254166667

00:12:51.114 --> 00:12:54.169 reality of the fact is that that

NOTE Confidence: 0.874401254166667

00:12:54.169 --> 00:12:56.081 they currently offer voluntary

NOTE Confidence: 0.874401254166667

00:12:56.081 --> 00:12:57.640 precertification and that all of

NOTE Confidence: 0.874401254166667

00:12:57.640 --> 00:12:59.260 these tools actually need to be

NOTE Confidence: 0.874401254166667

00:12:59.324 --> 00:13:01.340 frozen in terms of their algorithm,

NOTE Confidence: 0.874401254166667

00:13:01.340 --> 00:13:02.855 because before they get approved

NOTE Confidence: 0.874401254166667

00:13:02.855 --> 00:13:04.980 and once we update the algorithm,

NOTE Confidence: 0.874401254166667

00:13:04.980 --> 00:13:06.714 we essentially have to repeat the

NOTE Confidence: 0.874401254166667

00:13:06.714 --> 00:13:08.196 entire approval process and which

NOTE Confidence: 0.874401254166667

00:13:08.196 --> 00:13:09.576 is very cumbersome right now.

NOTE Confidence: 0.874401254166667

00:13:09.580 --> 00:13:11.200 But maybe helpful.

NOTE Confidence: 0.874401254166667

00:13:11.200 --> 00:13:11.833 Sorry to interrupt,

NOTE Confidence: 0.874401254166667

00:13:11.833 --> 00:13:13.792 but we need you to wrap up very

NOTE Confidence: 0.874401254166667

00:13:13.792 --> 00:13:15.618 soon as I am about to wrap up.

NOTE Confidence: 0.874401254166667

00:13:15.620 --> 00:13:16.348 So basically,

NOTE Confidence: 0.874401254166667

00:13:16.348 --> 00:13:18.896 basically where do we stand for now?

NOTE Confidence: 0.874401254166667

00:13:18.900 --> 00:13:20.010 And we're just getting started.

NOTE Confidence: 0.874401254166667

00:13:20.010 --> 00:13:22.786 This is the 8020 rule for many events.

NOTE Confidence: 0.874401254166667

00:13:22.790 --> 00:13:24.722 Roughly 80% of the effects come

NOTE Confidence: 0.874401254166667

00:13:24.722 --> 00:13:26.123 from 20% of the causes.

NOTE Confidence: 0.874401254166667

00:13:26.123 --> 00:13:27.629 This is the parade of rule.

NOTE Confidence: 0.874401254166667

00:13:27.630 --> 00:13:28.450 This is not the end,

NOTE Confidence: 0.874401254166667

00:13:28.450 --> 00:13:30.004 but rather the end of the beginning.

NOTE Confidence: 0.874401254166667

00:13:30.010 --> 00:13:32.106 80% of the effort is yet to be

NOTE Confidence: 0.874401254166667

00:13:32.106 --> 00:13:34.177 completed and data is too complex to

NOTE Confidence: 0.874401254166667

00:13:34.177 --> 00:13:36.419 be handled manually and the age of

NOTE Confidence: 0.874401254166667

00:13:36.419 --> 00:13:38.827 artificial intelligence is here with the eye,

NOTE Confidence: 0.874401254166667

00:13:38.830 --> 00:13:40.438 we can reach a new level

NOTE Confidence: 0.874401254166667

00:13:40.438 --> 00:13:41.242 of personalized medicine,

NOTE Confidence: 0.874401254166667

00:13:41.250 --> 00:13:42.874 and with that I'd like to conclude

NOTE Confidence: 0.874401254166667

00:13:42.874 --> 00:13:44.464 and say the final thought is

NOTE Confidence: 0.874401254166667

00:13:44.464 --> 00:13:46.144 really to curb the AI enthusiasm.

NOTE Confidence: 0.874401254166667

00:13:46.150 --> 00:13:48.187 I think we really need to 1st

NOTE Confidence: 0.874401254166667

00:13:48.187 --> 00:13:50.328 stand back and focus on the data.

NOTE Confidence: 0.874401254166667

00:13:50.330 --> 00:13:53.072 And try to build institutional and

NOTE Confidence: 0.874401254166667

00:13:53.072 --> 00:13:54.443 super institutional databases.

NOTE Confidence: 0.874401254166667

00:13:54.450 --> 00:13:56.394 That will help us develop those

NOTE Confidence: 0.874401254166667

00:13:56.394 --> 00:13:57.690 algorithms and validate them.

NOTE Confidence: 0.874401254166667

00:13:57.690 --> 00:13:58.348 With that,

NOTE Confidence: 0.874401254166667

00:13:58.348 --> 00:14:00.651 I'd like to thank the Yale Biomedical

NOTE Confidence: 0.874401254166667

00:14:00.651 --> 00:14:02.847 Engineering and Biomedical imaging community.

NOTE Confidence: 0.874401254166667

00:14:02.850 --> 00:14:04.452 All of these people are amazing

NOTE Confidence: 0.874401254166667

00:14:04.452 --> 00:14:06.189 mentors and we have a unique

NOTE Confidence: 0.874401254166667

00:14:06.189 --> 00:14:07.709 environment to really thrive in

NOTE Confidence: 0.874401254166667

00:14:07.709 --> 00:14:09.100 this component of science.

NOTE Confidence: 0.874401254166667

00:14:09.100 --> 00:14:11.039 And I would like also to thank

NOTE Confidence: 0.874401254166667

00:14:11.039 --> 00:14:12.827 several other mentors that I have had

NOTE Confidence: 0.874401254166667

00:14:12.827 --> 00:14:14.867 that enabled me to do this kind of

NOTE Confidence: 0.874401254166667

00:14:14.867 --> 00:14:16.467 research within our wonderful lab,

NOTE Confidence: 0.874401254166667

00:14:16.470 --> 00:14:17.910 the clinical lab of interventional

NOTE Confidence: 0.874401254166667

00:14:17.910 --> 00:14:19.969 oncology here at the Department of Radiology.