SUCCESS STORY

NEXTGEN RCM PROCESS THROUGH AI NLU-POWERED SPEECH ENGINE: ACHIEVE 20X TIME SAVINGS

PROJECT OVERVIEW

To improve the accuracy of the claim submission process with clinical evidences/medical documents, the client wanted to build a product that could redefine the RCM process with digital automation. This includes automating the transcription of doctor-patient encounters and generating clinical summaries that can be used to simplify and accelerate the claim submission process using AI and Natural Language Understanding (NLU)-powered speech engines. Improving operational efficiency, First Pass Rate and reducing the claim denial rate are the key business drivers.

SOLUTION DELIVERED

Near-real-time voice-to-text transcription using the NLU model and claims data extraction for immediate consumption by point-of-care systems.

CLIENT DOMAIN

Healthcare

KEY HIGHLIGHTS

- Extracting critical data to generate a patient summary from 20,000–40,000 lines of transcript takes 2 days; the Indium AI NLU solution does it in near-real time.
- Generates a precise patient summary report with nearly 70 critical elements required to build claim 837 in just an hour.
- The model currently can predict 2-3 distinct voices but has the potential to expand to predict 4-5 speakers.
- Accelerated the claim submission process and created first-time-right claims.
- Achieved an impressive 80–90% accuracy in transcription.
- A significant improvement of 40–50% in efficiency has been achieved
- Error-free healthcare data; captured directly from doctor-patient conversations.
- Granular details such as medication history, diagnosis, and treatment plan, along with the codes, are captured.

ABOUT CLIENT

The client is a technology service provider of healthcare platforms for hospital systems and RCM companies that partner with hospitals, specialized clinics, health systems, health information exchanges, and integrated delivery networks to offer high-caliber, expert-level services and solutions across the globe.

BUSINESS CHALLENGES

- Healthcare organizations face numerous challenges, including the requirement to take accurate clinical notes during patient consultations.
- Clinical note creation impacts the efficiency of healthcare providers and led to errors such as missing critical patient information.
- The need to identify healthcare-specific terms in conversations and extract relevant metadata information, such as timestamps, the number of visits, medication lists, and vitals is critical, while protecting patient privacy and data security.
- Employing traditional methods to recognize the voices of doctors/providers, patients, and nurses; identify the conversation's context; and summarize it into easily accessible text delays the process.
- Furthermore, extracting relevant data from the doctor-patient transcript for processing claims without errors to submit to payers took a long time for the client.

SOLUTION HIGHLIGHTS

PROCESS FLOW

- The solution integrates with the client server and EHR system to process physician appointments.
- The mobile application captures patient-physician conversations and stores the audio call logs in AWS S3 buckets.
- The NLU engine processes the audio call logs and segments different speakers to provide a text transcript of the entire discussion.
- The solution extracts the necessary metadata from the transcript to create a precise patient summary report in less than an hour in Word format.
- The patient summary report has nearly 70 data elements needed to submit a claim and is attached with ICD codes.

1. AI-NLU-powered speech engine

Indium deployed an AI model powered by the Natural Language Understanding (NLU) speech engine to swiftly transcribe audio recordings of doctor-patient encounters in near real-time.

2. Voice input from the mobile app

The mobile app captures audio input, which is then routed to the ML model for further processing. Leveraging Python, complex automation pipelines were built.

3. Decryption and pre-processing

The model is compatible with a variety of high-quality audio file formats, including mp3, m4a, wav, and AAC. Advanced pre-processing methods greatly decreased transcription delays and enabled noise cancellation. Pydub was used to read and process audio files in various formats. With the help of automatic speech recognition (ASR) models built using PyTorch, Indium transcribed ~20-30 pages of medical consultations or patient interactions (audio recordings) into text.

4. Speaker diarization

The model precisely identifies physicians, patients, and other voice/speech by separating an audio recording into segments corresponding to different speakers. Spectral cluster method is employed to process the audio, while a speaker diarization model built with SciPy and sci-kit learn was trained to recognize and distinguish different speakers in the conversation.

5. Speaker verification and diagnostic study

Pydhub is used to extract useful information for further analysis which helps the providers handle the Mediclaim efficiently. They used NLP algorithms to extract salient information such as patient history, present illness, and diagnostic reports from the audio transcription and create a concise summary.

6. Speech transcription

PyTorch-based deep learning model is used for the transcription of lengthy physician encounters. It helped the client extract the most critical information from audio files and present it concisely, enabling healthcare professionals to quickly grasp essential details.

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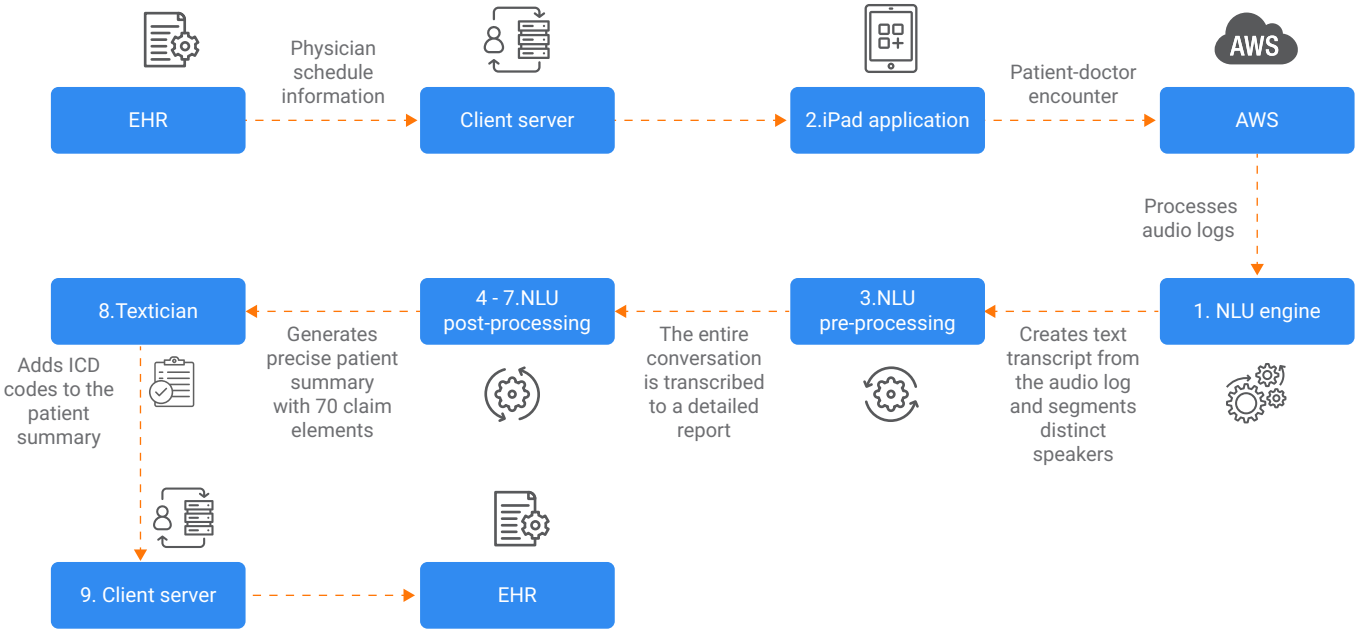

7. Encryption
JamSpell helps correct spelling errors, which are critical for maintaining accurate and reliable medical records. HIPPA compliant encryption algorithm (AES-GCM) is used to encrypt the reports.

8. Post-processing
The final patient summary reports are transferred to the Textician system integrated into the NLU model to add ICD codes. As it requires time for insurance companies to crack medical terminologies, attaching ICD codes to medical terms and phrases helps them accelerate the claim submission process.

9. Data storage and consumption
The client (point-of-care systems) uses reports made up of crucial claim data and ICD codes stored in their portal to efficiently create claim forms and handle submissions to payers.

BUSINESS IMPACT

- Automating patient-doctor encounters with AI NLU-powered speech engine helped achieve 20x time savings.
- The near-real-time generation of patient summary reports and claim data extraction improved operational efficiency by 90%.
- The solution accelerated the claims submission process with first-time-right claims, saving huge costs incurred due to manual errors and methods.
- The report containing 85% of the data required to submit to insurance organizations is generated in less than an hour.
  An 85% transcription accuracy rate led to a substantial reduction in errors and improved documentation.
- Near-real-time transcription and data extraction greatly enhanced productivity and optimized resource reallocation by substantially cutting down on the time required from days to hours.

TECH STACK

python™ Pydub

JamSpell PyTorch

aws SciPy

scikit learn **Spectral cluster**

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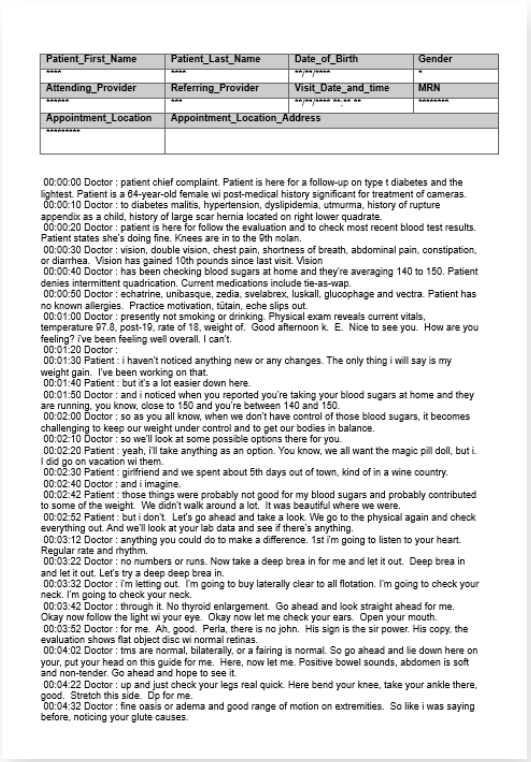
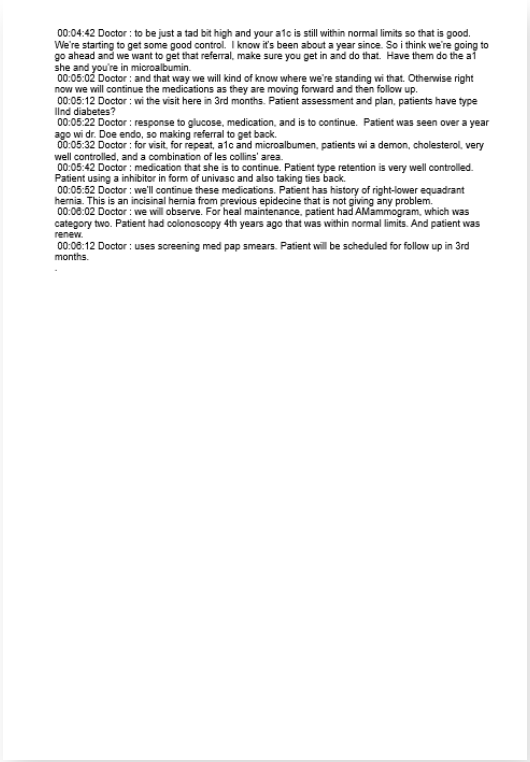
First-level report generated by the system



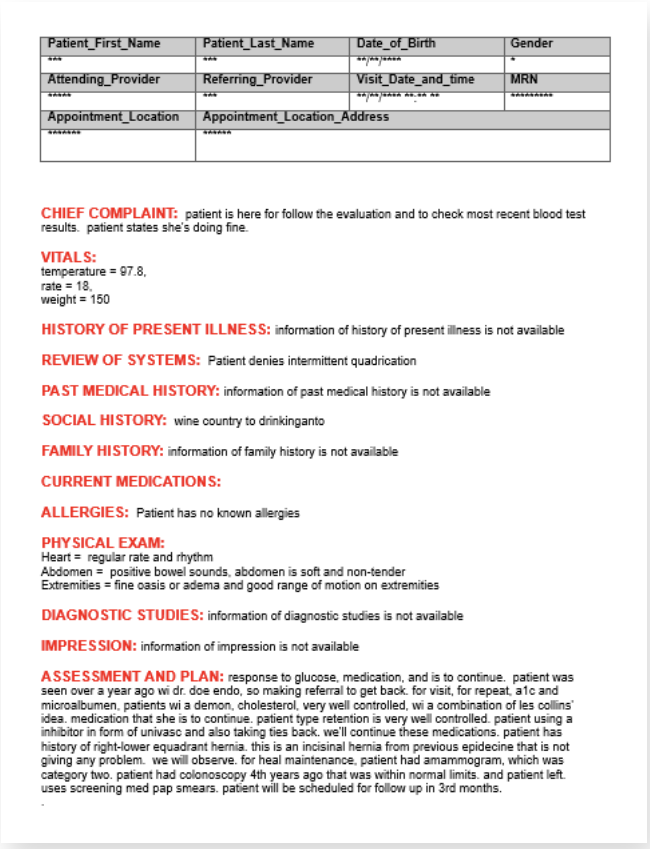
Patient_First_Name	Patient_Last_Name	Date_of_Birth	Gender
****	****	**/**/****	*
Attending_Provider	**Referring_Provider**	**Visit_Date_and_time**	**MRN**
******	***	**/**/**** **:** **	*********
Appointment_Location	**Appointment_Location_Address**		
*********			

00:00:00 Doctor : patient chief complaint. Patient is here for a follow-up on type t diabetes and the lightest. Patient is a 64-year-old female wi post-medical history significant for treatment of cameras.
00:00:10 Doctor : to diabetes malitis, hypertension, dyslipidemia, utmurma, history of rupture appendix as a child, history of large scar hernia located on right lower quadrate.
00:00:20 Doctor : patient is here for follow the evaluation and to check most recent blood test results. Patient states she's doing fine. Knees are in to the 9th nolan.
00:00:30 Doctor : vision, double vision, chest pain, shortness of breath, abdominal pain, constipation, or diarrhea. Vision has gained 10th pounds since last visit. Vision
00:00:40 Doctor : has been checking blood sugars at home and they're averaging 140 to 150. Patient denies intermittent quadrication. Current medications include tie-as-wap.
00:00:50 Doctor : echatrine, unibasque, zedia, svelabrex, luskall, glucophage and vectra. Patient has no known allergies. Practice motivation, tiitain, eche slips out.
00:01:00 Doctor : presently not smoking or drinking. Physical exam reveals current vitals, temperature 97.8, post-19, rate of 18, weight of. Good afternoon k. E. Nice to see you. How are you feeling? i've been feeling well overall. I can't.
00:01:20 Doctor :
00:01:30 Patient : i haven't noticed anything new or any changes. The only thing i will say is my weight gain. I've been working on that.
00:01:40 Patient : but it's a lot easier down here.
00:01:50 Doctor : and i noticed when you reported you're taking your blood sugars at home and they are running, you know, close to 150 and you're between 140 and 150.
00:02:00 Doctor : so as you all know, when we don't have control of those blood sugars, it becomes challenging to keep our weight under control and to get our bodies in balance.
00:02:10 Doctor : so we'll look at some possible options there for you.
00:02:20 Patient : yeah, i'll take anything as an option. You know, we all want the magic pill doll, but i. I did go on vacation wi them.
00:02:30 Patient : girlfriend and we spent about 5th days out of town, kind of in a wine country.
00:02:40 Doctor : and i imagine.
00:02:42 Patient : those things were probably not good for my blood sugars and probably contributed to some of the weight. We didn't walk around a lot. It was beautiful where we were.
00:02:52 Patient : but i don't. Let's go ahead and take a look. We go to the physical again and check everything out. And we'll look at your lab data and see if there's anything.
00:03:12 Doctor : anything you could do to make a difference. 1st i'm going to listen to your heart. Regular rate and rhythm.
00:03:22 Doctor : no numbers or runs. Now take a deep brea in for me and let it out. Deep brea in and let it out. Let's try a deep deep brea in.
00:03:32 Doctor : i'm letting out. I'm going to buy laterally clear to all flotation. I'm going to check your neck. I'm going to check your neck.
00:03:42 Doctor : through it. No thyroid enlargement. Go ahead and look straight ahead for me. Okay now follow the light wi your eye. Okay now let me check your ears. Open your mouth.
00:03:52 Doctor : for me. Ah, good. Perla, there is no john. His sign is the sir power. His copy, the evaluation shows flat object disc wi normal retinas.
00:04:02 Doctor : tms are normal, bilaterally, or a fairing is normal. So go ahead and lie down here on your, put your head on this guide for me. Here, now let me. Positive bowel sounds, abdomen is soft and non-tender. Go ahead and hope to see it.
00:04:22 Doctor : up and just check your legs real quick. Here bend your knee, take your ankle there, good. Stretch this side. Dp for me.
00:04:32 Doctor : fine oasis or adema and good range of motion on extremities. So like i was saying before, noticing your glute causes.



00:04:42 Doctor : to be just a tad bit high and your a1c is still within normal limits so that is good. We're starting to get some good control. I know it's been about a year since. So i think we're going to go ahead and we want to get that referral, make sure you get in and do that. Have them do the a1 she and you're in microalbumin.
00:05:02 Doctor : and that way we will kind of know where we're standing wi that. Otherwise right now we will continue the medications as they are moving forward and then follow up.
00:05:12 Doctor : wi the visit here in 3rd months. Patient assessment and plan, patients have type IInd diabetes?
00:05:22 Doctor : response to glucose, medication, and is to continue. Patient was seen over a year ago wi dr. Doe endo, so making referral to get back.
00:05:32 Doctor : for visit, for repeat, a1c and microalbumen, patients wi a demon, cholesterol, very well controlled, and a combination of les collins' area.
00:05:42 Doctor : medication that she is to continue. Patient type retention is very well controlled. Patient using a inhibitor in form of univasc and also taking ties back.
00:05:52 Doctor : we'll continue these medications. Patient has history of right-lower equadrant hernia. This is an incisinal hernia from previous epidecine that is not giving any problem.
00:06:02 Doctor : we will observe. For heal maintenance, patient had AMammogram, which was category two. Patient had colonoscopy 4th years ago that was within normal limits. And patient was renew.
00:06:12 Doctor : uses screening med pap smears. Patient will be scheduled for follow up in 3rd months.

Final patient summary before adding ICD codes



Patient_First_Name	Patient_Last_Name	Date_of_Birth	Gender
***	***	**/**/****	*
Attending_Provider	**Referring_Provider**	**Visit_Date_and_time**	**MRN**
*****	***	**/**/**** **:** **	*********
Appointment_Location	**Appointment_Location_Address**		
*******	******		

CHIEF COMPLAINT: patient is here for follow the evaluation and to check most recent blood test results. patient states she's doing fine.

VITALS:
temperature = 97.8,
rate = 18,
weight = 150

HISTORY OF PRESENT ILLNESS: information of history of present illness is not available

REVIEW OF SYSTEMS: Patient denies intermittent quadrication

PAST MEDICAL HISTORY: information of past medical history is not available

SOCIAL HISTORY: wine country to drinkinganto

FAMILY HISTORY: information of family history is not available

CURRENT MEDICATIONS:

ALLERGIES: Patient has no known allergies

PHYSICAL EXAM:
Heart = regular rate and rhythm
Abdomen = positive bowel sounds, abdomen is soft and non-tender
Extremities = fine oasis or adema and good range of motion on extremities

DIAGNOSTIC STUDIES: information of diagnostic studies is not available

IMPRESSION: information of impression is not available

ASSESSMENT AND PLAN: response to glucose, medication, and is to continue. patient was seen over a year ago wi dr. doe endo, so making referral to get back. for visit, for repeat, a1c and microalbumen, patients wi a demon, cholesterol, very well controlled, wi a combination of les collins' idea. medication that she is to continue. patient type retention is very well controlled. patient using a inhibitor in form of univasc and also taking ties back. we'll continue these medications. patient has history of right-lower equadrant hernia. this is an incisinal hernia from previous epidecine that is not giving any problem. we will observe. for heal maintenance, patient had amammogram, which was category two. patient had colonoscopy 4th years ago that was within normal limits. and patient left. uses screening med pap smears. patient will be scheduled for follow up in 3rd months.

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ABOUT INDIUM

Indium Software is a fast-growing Digital Engineering company, focused on building modern solutions across Applications, Data, and Gaming for its clients. With deep expertise in next-gen offerings combining data and applications, Indium offers a wide range of services including Product Engineering, Low-Code development, Data Engineering, Ai/ML, Digital Assurance, and end-to-end Gaming services.

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