Hi John. I’d be happy to meet up next week. Please work with Amy (CC’ed) to get this on the calendar. Looking forward to it. //Michael. :-)

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Angela Zhou --- angela@human.x.ai
● Introduction to Amy
● High Level Architecture
● Meeting Locations
● Location Pipeline
● Location Detection

Hi John. I’d be happy to meet up next week. Please work with Amy (CC’ed) to get this on the calendar. Looking forward to it. //Michael. :-)

Cc: amy@x.ai
Pain of Scheduling Meetings

When you receive a meeting request from your business partners or friends, what do you need to do?

Hi Angela, How was Canada? Are you back? I'm in NYC now and I'll be here for a few days. I'd love to catch up if you've got the time!
Hey Lewis, definitely!
I just got back from Canada.
How is everything going?
Do you want to have coffee on Friday? How about the Starbucks near x.ai NYC office.

Hi Angela, How was Canada? Are you back?
I'm in NYC now and I'll be here for a few days. I'd love to catch up if you've got the time!
Pain of Scheduling Meetings

Then your friend can suggest a specific time on that date

---

**Angela**
Hey Lewis, definitely!
I just got back from Canada. How is everything going?
Do you want to have coffee on Friday? How about the Starbucks near x.ai NYC office.

---

**Lewis**
Hi Angela, How was Canada? Are you back?
I'm in NYC now and I'll be here for a few days. I'd love to catch up if you've got the time!

---

**Angela**
Yea that sounds good. What about Friday at 1pm?
Introduction

Pain of Scheduling Meetings

What if that time doesn’t work for you?

Hey Lewis, definitely! I just got back from Canada. How is everything going? Do you want to have coffee on Friday? How about the Starbucks near x.ai NYC office.

Hi Angela, How was Canada? Are you back? I'm in NYC now and I'll be here for a few days. I'd love to catch up if you've got the time!

Oh I have a meeting at 1pm on Friday. Can we meet at 2?

Yea that sounds good. What about Friday at 1pm?
Pain of Scheduling Meetings

If that time works for your friend, he or she will accept it.

**Angela**

Hey Lewis, definitely! I just got back from Canada. How is everything going? Do you want to have coffee on Friday? How about the Starbucks near x.ai NYC office.

Oh I have a meeting at 1pm on Friday. Can we meet at 2?

**Lewis**

Hi Angela, How was Canada? Are you back? I'm in NYC now and I'll be here for a few days. I'd love to catch up if you've got the time!

Yea that sounds good. What about Friday at 1pm?

Sure. That works for me! See you there.
Pain of Scheduling Meetings

Reply to Confirm. Is that the end?

Hey Lewis, definitely!
I just got back from Canada. How is everything going? Do you want to have coffee on Friday? How about the Starbucks near x.ai NYC office.

Oh I have a meeting at 1pm on Friday. Can we meet at 2?

Awesome. See you!

Hi Angela, How was Canada? Are you back? I’m in NYC now and I’ll be here for a few days. I’d love to catch up if you’ve got the time!

Yea that sounds good. What about Friday at 1pm?

Sure. That works for me! See you there.
Pain of Scheduling Meetings

Say you schedule 8 meetings a week.

Each meeting takes about 3.5 emails to negotiate.

And you spend 5 minutes reading the incoming email and writing the response.

That’s $8 \times 3.5 \times 5 = 140 \text{ mins/week (2.33 hrs/week)}$

Or about 10 hrs/month spent on scheduling meetings.
Introduction

Solution with Amy

The back and forth will only happen between Lewis and Amy. Both Lewis and Angela will receive a calendar invite.

Angela

Hey Lewis, definitely! I just got back from Canada. How is everything going? Do you want to have coffee on Friday? How about the Starbucks near x.ai NYC office. Amy can help us with it.

Lewis

Hi Angela, How was Canada? Are you back? I'm in NYC now and I'll be here for a few days. I'd love to catch up if you've got the time!

Amy

Cc: amy @ x.ai

- 7
Hey Lewis, definitely!
I just got back from Canada. How is everything going?
Do you want to have coffee on Friday? How about the Starbucks near x.ai NYC office.
Amy can help us with it.
High Level Architecture

Incoming Emails → Preprocessing → Entity Extraction → Intent Classification → Composer

NLP

NLG

Outgoing Emails
Calendar Invites

= External Services
= Amy's Brain
Find existing conversations between the participants
Find existing conversations between the participants

Clean the data and extract metadata
From text to real objects
Oh I have a meeting at 1pm on Friday. Can we meet at 2?
Incoming Emails → Preprocessing → Entity Extraction → Composer → Outgoing Emails

Entity Extraction → Intent Classification

Composer → Calendar Invites

High Level Architecture

Entities
- Intents
- User Preferences
- Calendar

NLP

NLG
High Level Architecture

Incoming Emails → Preprocessing → Entity Extraction → Intent Classification → Composer

NLG

Outgoing Emails → Calendar Invites

NLP

= External Services

= Amy's Brain
Meeting Elements

WHERE & HOW

WHO

WHEN
Meeting Elements

WHERE & HOW
Meeting Locations

Address: Geographical Point on the Map
Meeting Locations

Physical meeting types
Meeting Locations

Remote meeting types
Meeting Locations
Hey Lewis, definitely! I just got back from Canada. How is everything going? Do you want to have coffee on Friday? How about the Starbucks near x.ai NYC office. Amy can help us with it.
Hey Lewis, definitely!
I just got back from Canada. How is everything going?
Do you want to have coffee on Friday? How about the Starbucks near x.ai NYC office.
Amy can help us with it.
Hey Lewis, definitely!
I just got back from Canada. How is everything going?
Do you want to have coffee on Friday? How about the Starbucks near x.ai NYC office.
Amy can help us with it.
Hey Lewis, definitely!
I just got back from **Canada**. How is everything going?
Do you want to have **coffee** on Friday? How about the **Starbucks** near **x.ai NYC office**.
Amy can help us with it.
Hey Lewis, definitely!
I just got back from Canada. How is everything going?
Do you want to have coffee on Friday? How about the Starbucks near x.ai NYC office.
Amy can help us with it.
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Amy can help us with it.

coffee
Starbucks
Hey Lewis, definitely!
I just got back from Canada. How is everything going?
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Hey Lewis, definitely!
I just got back from Canada. How is everything going?
Do you want to have coffee on Friday? How about the Starbucks near x.ai NYC office.
Amy can help us with it.

(From Lewis)

Amy Ingram

10:47 AM (4 minutes ago) ⭐

to me

Hi Lewis,

Angela likes Starbucks, 2 Broadway, New York, NY 10004, USA.

I'll go ahead and send out an invite for Friday, Sep 30 at 2:00 PM EDT.
Challenges

1. Multiple candidates in the target area

   e.g. Let’s meet at Starbucks near Times Square
Challenges

2. Problems of associating the preposition to the location

e.g. Let’s meet at the Starbucks at my office
Challenges

3. Wrong address

e.g. Let’s meet at x.ai 26 Broadway
Let’s meet at x.ai 25 Broadway
Location Detection

Conditional Random Fields (CRFs): discriminative undirected probabilistic graphical model

Directly model the conditional distribution $P(y|x)$
- $y$: the attributes of sequence we want to predict
- $x$: the observed knowledge from the input sequence

Linear-chain CRFs

General CRFs
Location Detection

Linear-Chain CRF

\[ p(y|x) = \frac{p(y, x)}{\sum_{y'} p(y', x)} = \frac{\prod_{t=1}^{T} \exp \left\{ \sum_{k=1}^{K} \theta_k f_k(y_t, y_{t-1}, x_t) \right\}}{\sum_{y'} \prod_{t=1}^{T} \exp \left\{ \sum_{k=1}^{K} \theta_k f_k(y'_t, y'_{t-1}, x_t) \right\}}. \]
Location Detection

Linear-Chain CRF

\[ p(y|x) = \frac{1}{Z(x)} \prod_{t=1}^{T} \exp \left\{ \sum_{k=1}^{K} \theta_k f_k(y_t, y_{t-1}, x_t) \right\} \]
Location Detection

Skip-Chain CRF: model certain kinds of long-range label dependencies

Location Detection

Long Short-Term Memory (LSTM)

Goal of Amy

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Hi Angela, How was Canada? Are you back?
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to catch up if you’ve got the time!

Amy

Lewis

Cc: amy @ x.ai

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Cc: amy@x.ai
angela @ human.x.ai
data scientist

25 Broadway
New York, NY 10004

E: hello@x.ai
T: @xdotai