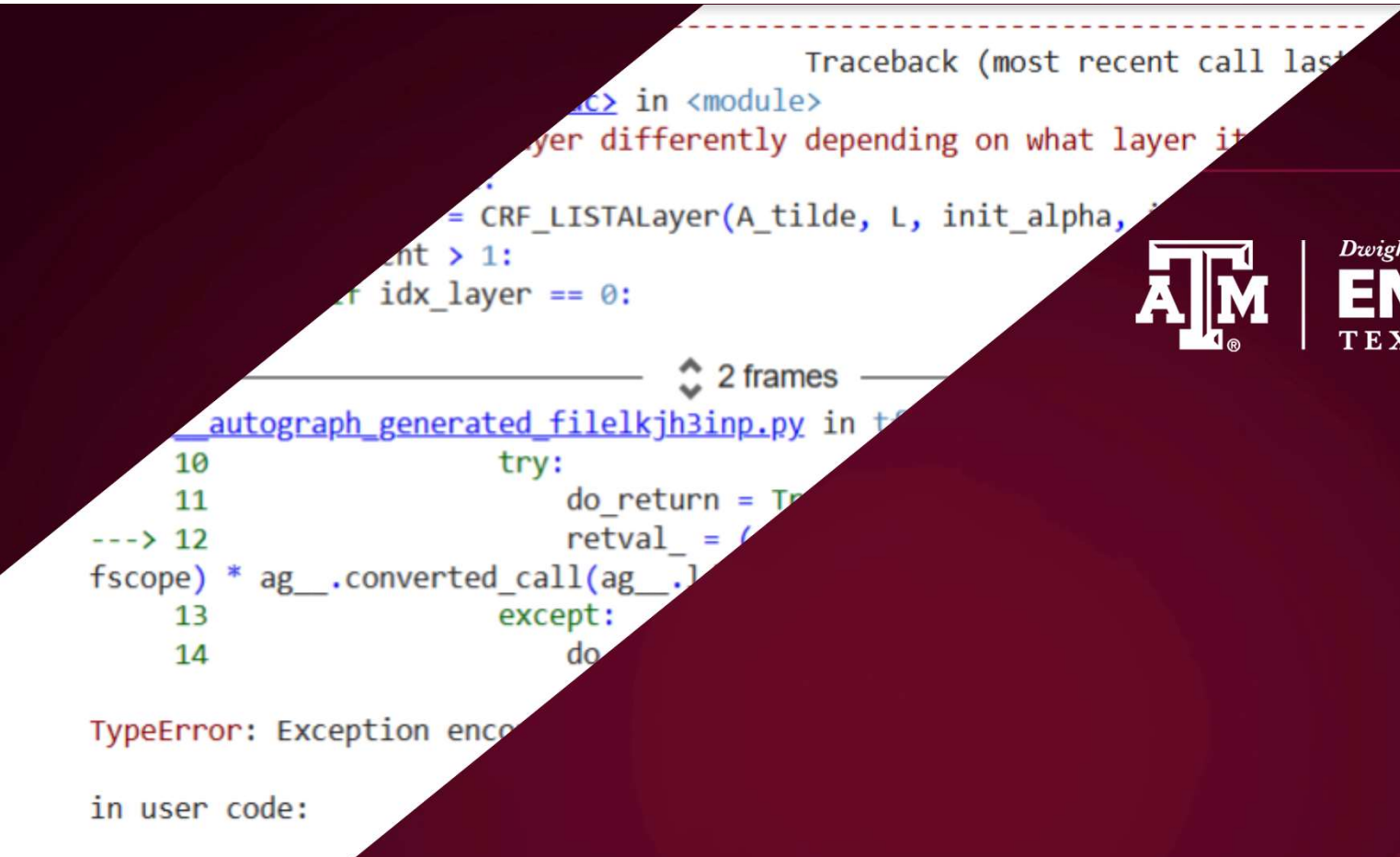

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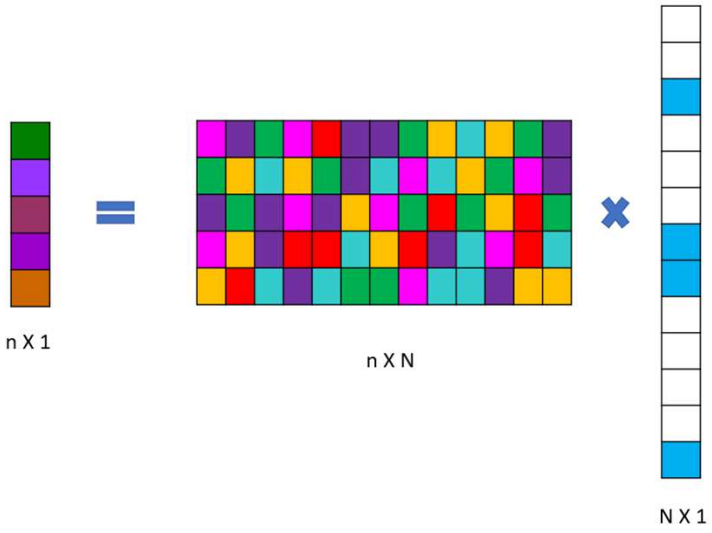
Team 64: Enhancing User Detection
Bi-Weekly Update 2

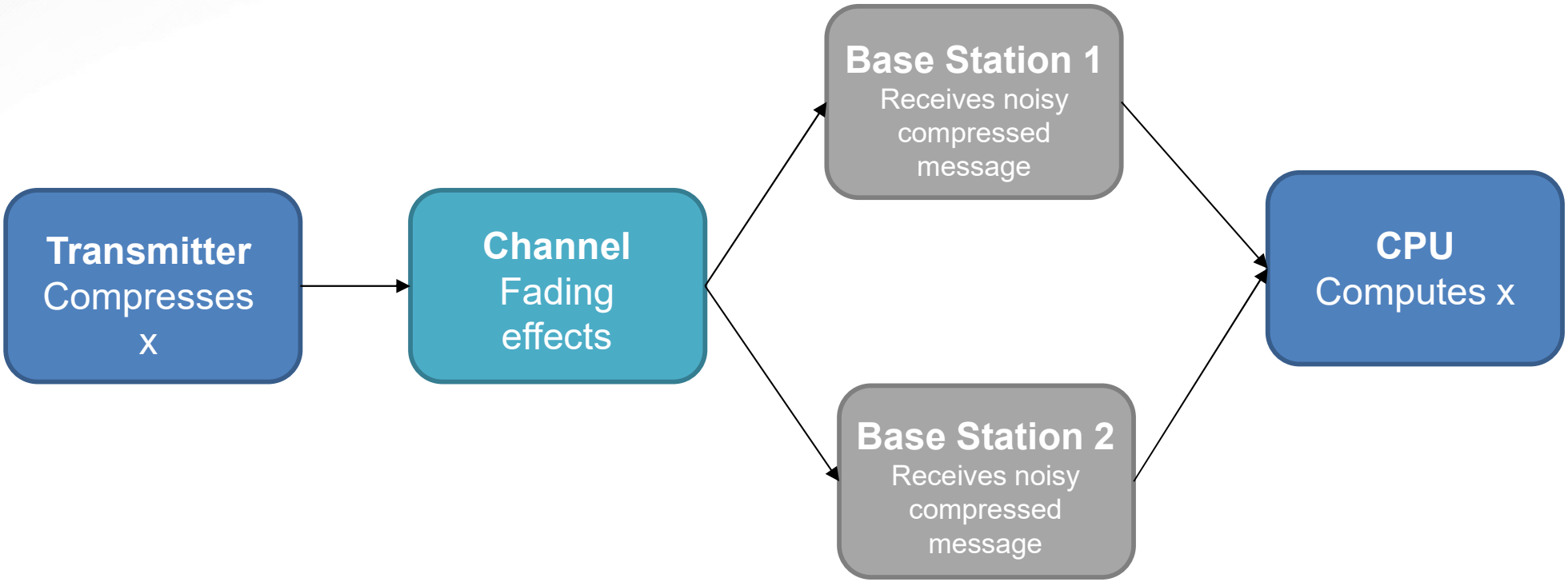
Holly Roper
Sponsor: Dr. Krishna Narayanan
Jamison Ebert
TA: Max Lesser

Project Summary

- We are seeking to enhance compressed sensing algorithms with deep learning
- Focusing on user detection
- Converting IST to a neural network (LISTA, TISTA)



Project Overview



Project Timeline

Implement unlearned algorithms	Implement LISTA	Add noise to all algorithms	Implement TISTA ★	Add Complex Rayleigh fading	Unlearned algorithm two base station baseline	Learned algorithms two base station approach

Unlearned Algorithms

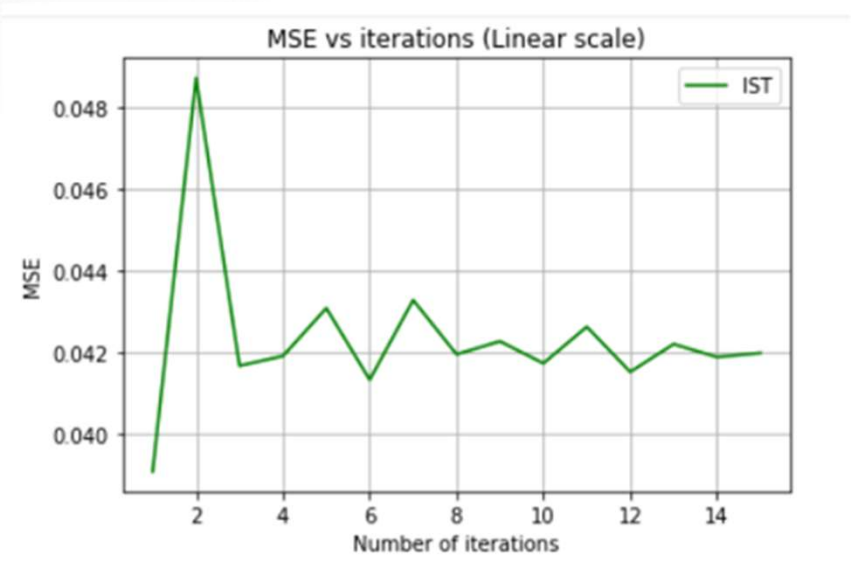
Holly

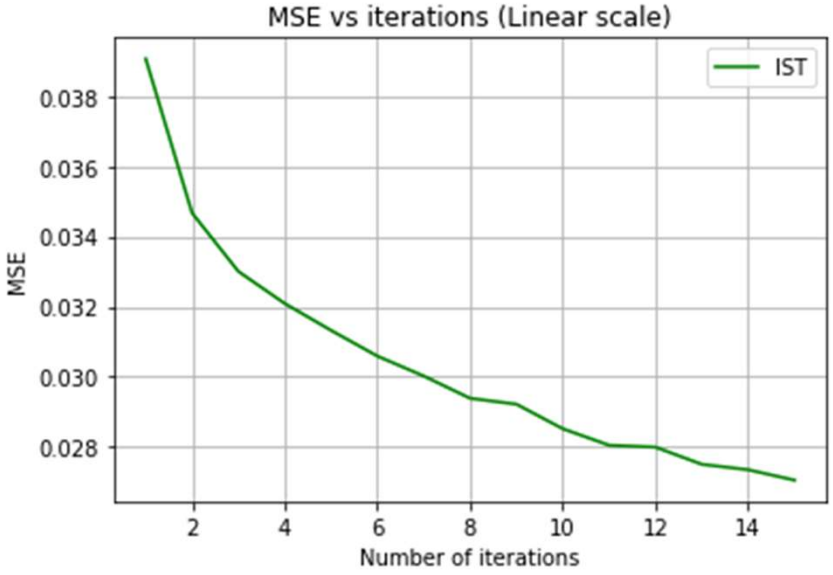
Accomplishments since last pres 5 hrs of effort	Ongoing progress/problems and plans until the next presentation
-Implemented a version of IST that can handle complex numbers -IST can now process with noise and Rayleigh fading	-CAMP*

*Complex AMP is, well, complex. At this time Dr. Narayanan has deemed it not worth our effort to pursue since our main focus is on IST.

Complex IST

Me, again





Found bug in my thresholding function and switched up SD with variance.

Learned Algorithms

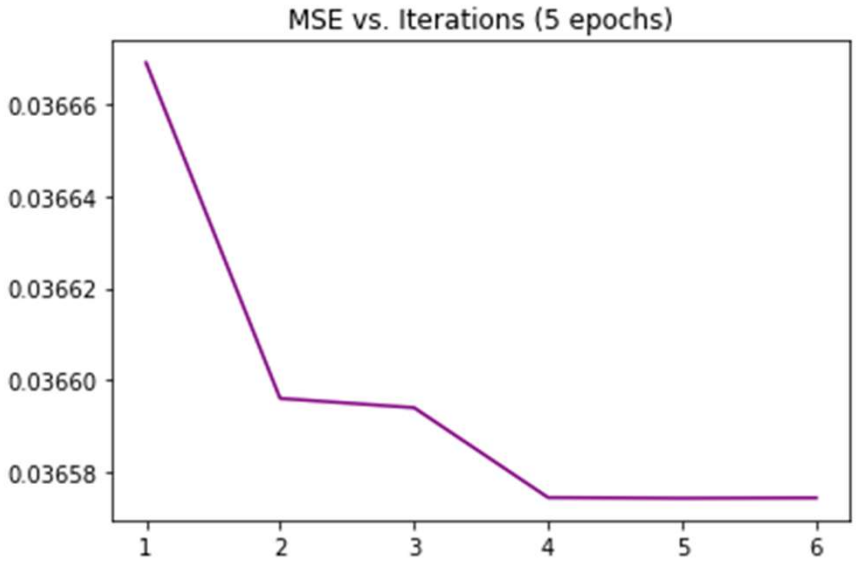
Still me

Accomplishments since last pres 12 hrs of effort	Ongoing progress/problems and plans until the next presentation
-Research on making LISTA able to handle complex values -Attempted to implement complex LISTA -Implemented TISTA	-Debugging LISTA, and getting a fresh set of eyes on it -Debugging TISTA, specifically determining why step size is not affecting performance

Learned Algorithms

You guessed it…me

TISTA: very miniscule downward trend




```
in user code:

    File "<ipython-input-7-4d563669d867>", line 18, in call  *
        new_x = tf_cmplx_eta(update, self.alpha/self.L)  # this is what makes it differ from other LISTA layer
    File "<ipython-input-25-20de539ff5f3>", line 2, in tf_cmplx_eta  *
        return tf.math.exp(1j*tf.math.angle(u)) * (tf.math.maximum(tf.math.abs(u)-T, 0))

    TypeError: Expected float32, but got 1j of type 'complex'.


Call arguments received by layer "crf_lista_layer_11" (type CRF_LISTALayer):
  • inputs=tf.Tensor(shape=(None, 1294), dtype=complex64)
```

Error as of last night

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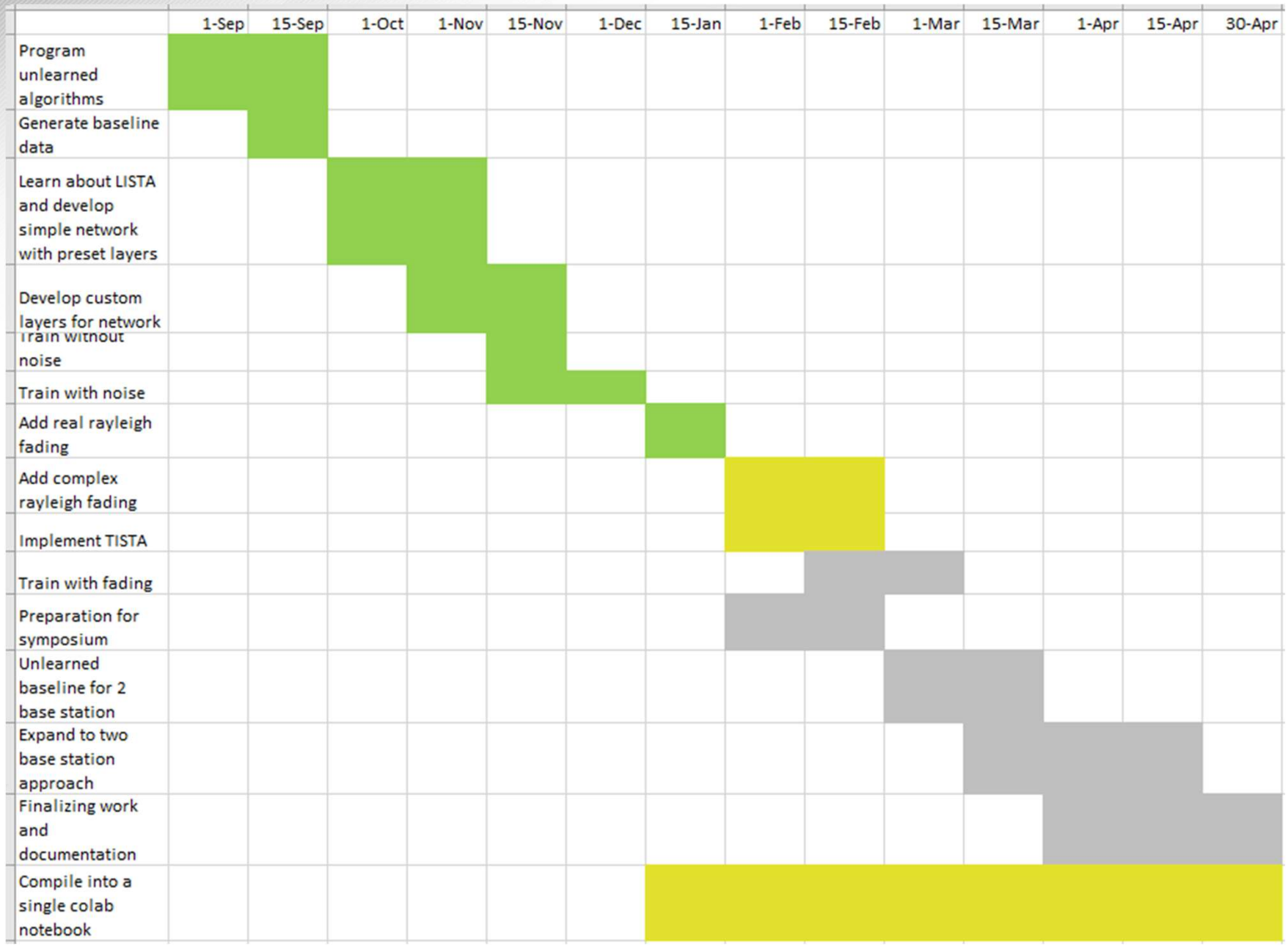
Execution Plan



Validation

We are evaluating MSE vs. iterations/layers.

The project is considered a success if the ML outperforms IST:

- With no noise
- With noise
- With fading
- With noise and fading

So far ML has outperformed IST with and without noise.

Thanks!