# wellfit
## A Deep Learning Model for Exercise Transcription

THE PROBLEM

Many wearable devices contain micro-electromechanical **(MEM)** sensors, which can be used in activity recognition. Our model **recognizes** and **transcribes** weight-lifting exercises by reading MEM input **sequences** collected during a workout.

MEM Input Sequence → Curl · Curl · Curl

MEM Input Sequence   **Exercise** Transcription
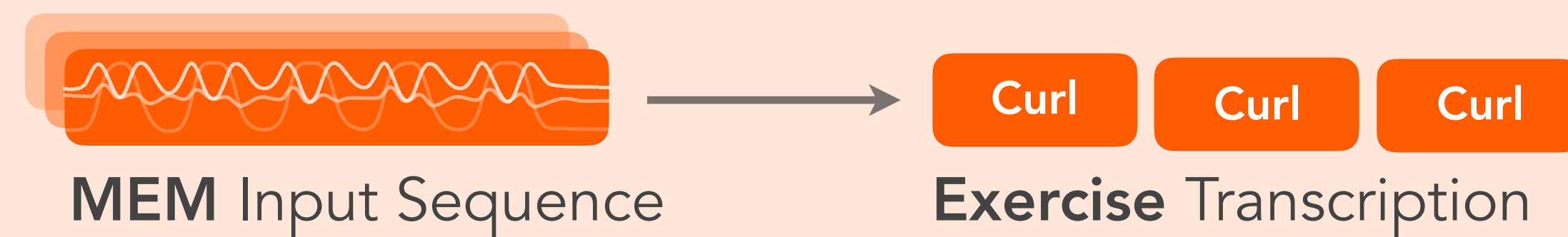
OUR DATASET

Our RepKit data collection app

Our Dataset

Our Database
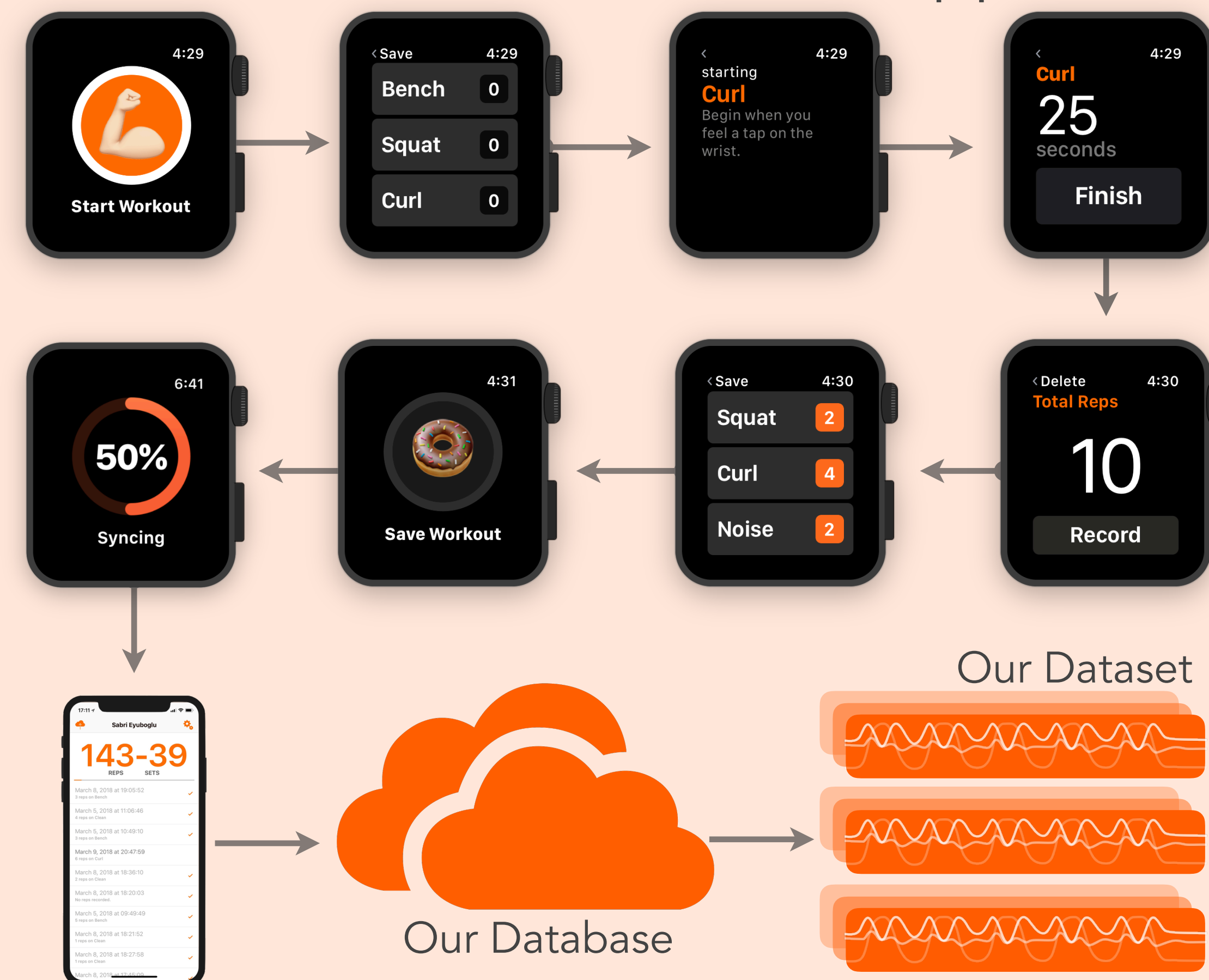
6 Lifters
Geoff   Sabri   Pierce
Rooz   Claire   Sophia

8,000 Reps

4 Exercises
Curl   Squat
Bench   Clean

2,300 Sets

MODEL ARCHITECTURE

MEM Input Sequences

1-D Convolutional Layer

Large stride "down-samples" the data
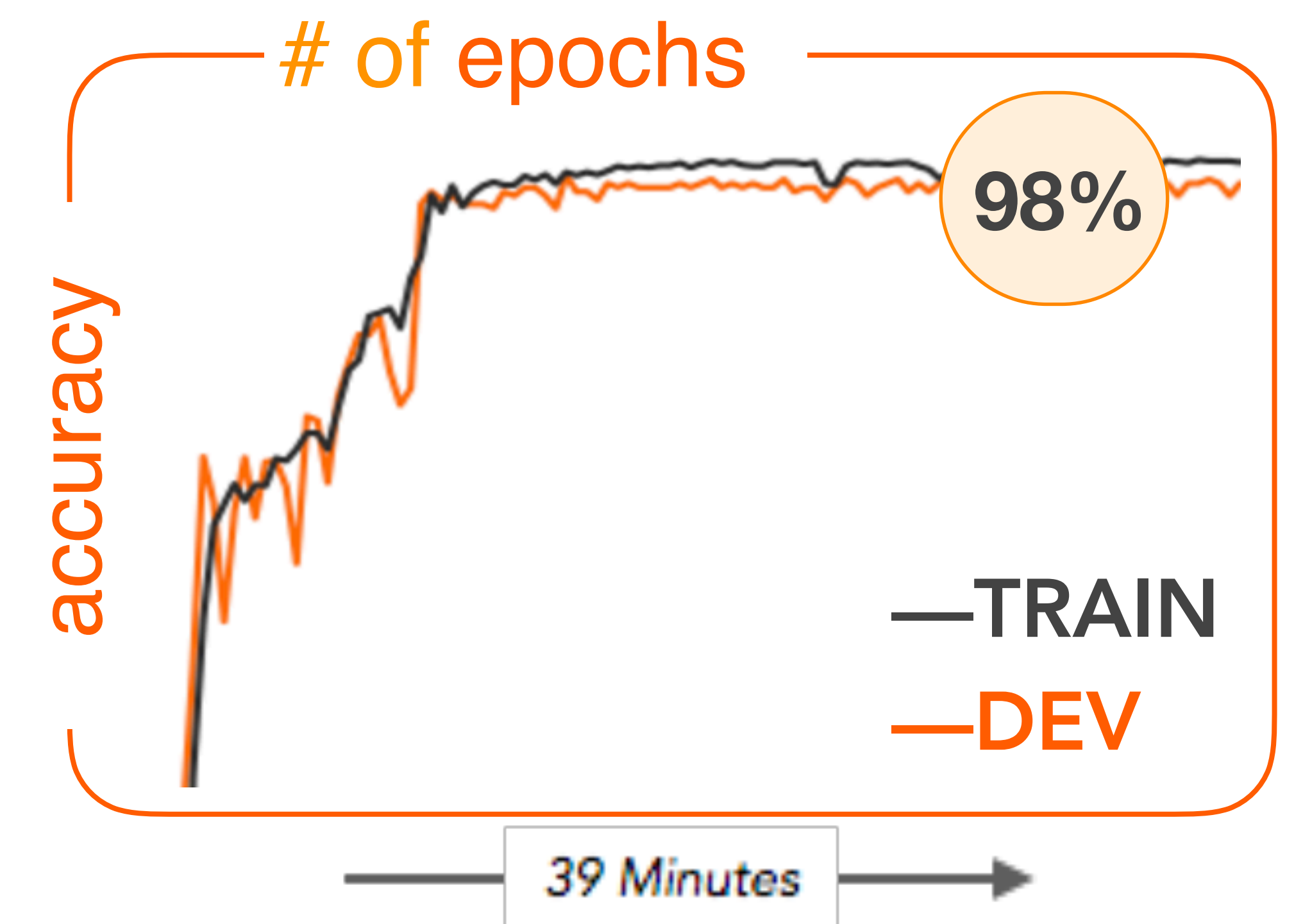
Bidirectional LSTM Layer

Squat · Squat · Blank · Squat

Squat   Squat

CTC Loss with
Beam Search Decoder

MODEL VISUALIZATION

ATTITUDE (ROLL, PITCH, YAW)

GRAVITY (X, Y, Z)

LSTM SOFTMAX OUTPUT   —CURL —BLANK

1
0.75
0.5
0.25
0

TIME

MODEL TRAINING

of epochs

accuracy

98%

—TRAIN
—DEV

39 Minutes
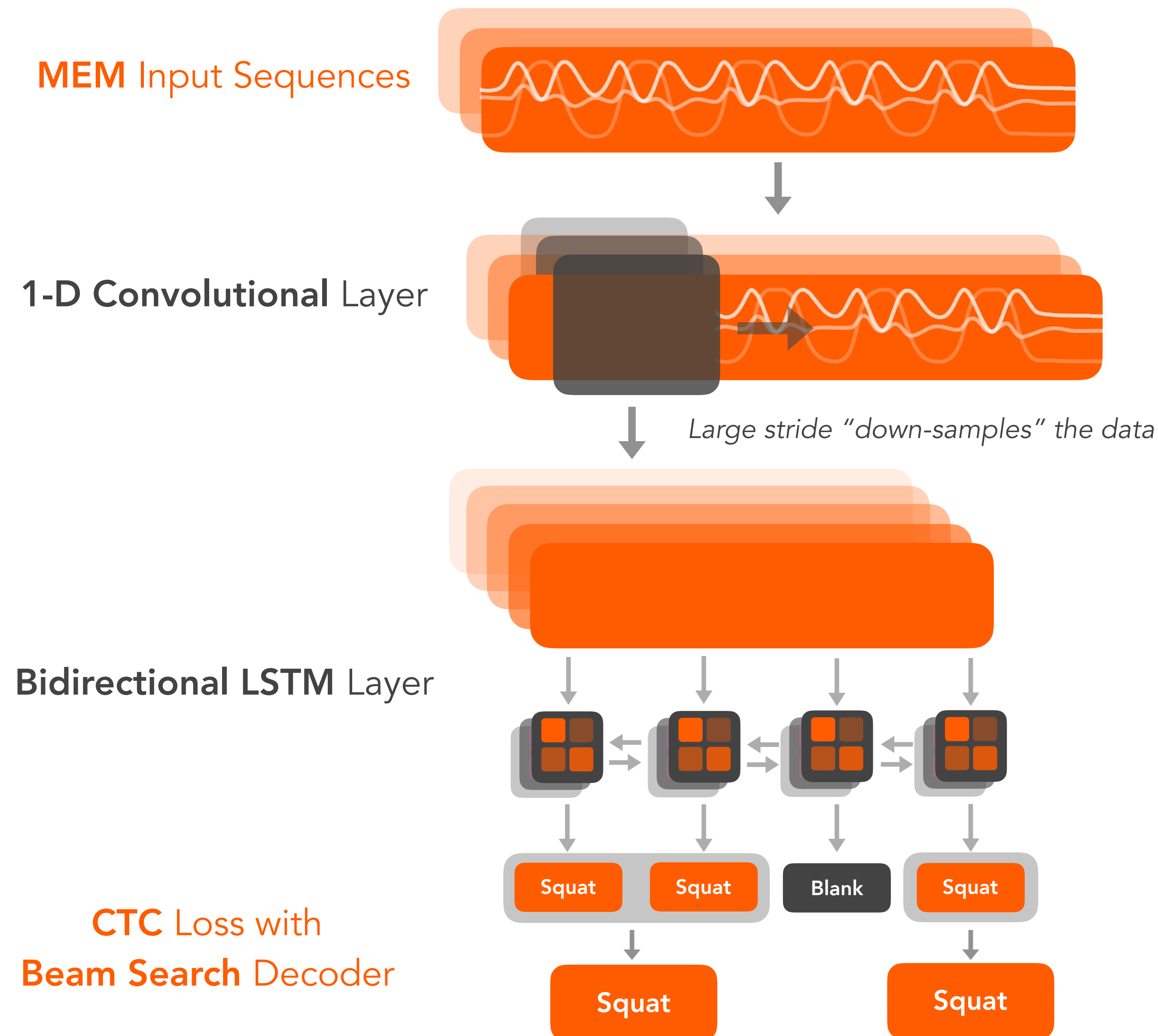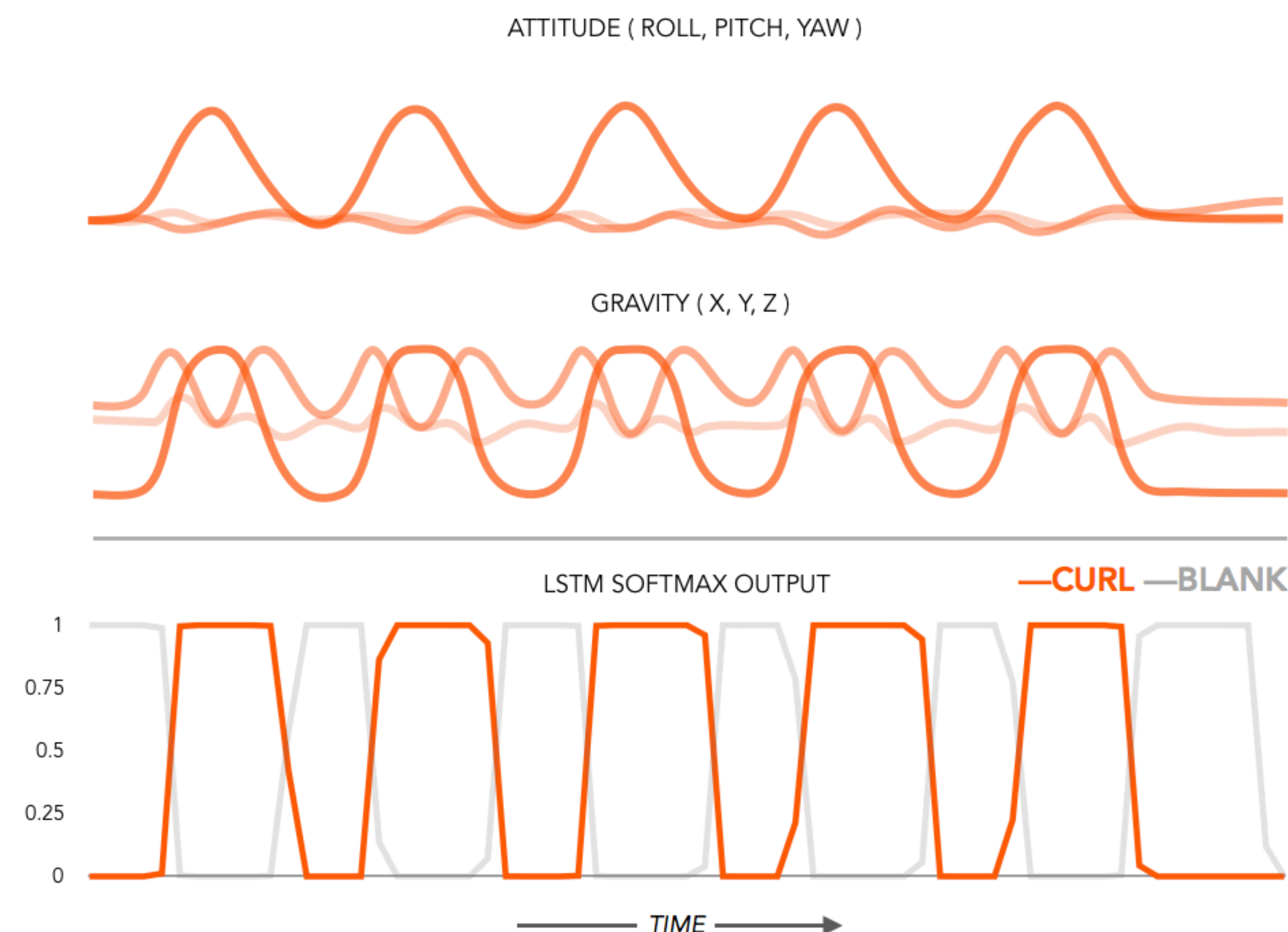
THE RESULTS

Our TRAIN set came from 5 out of the 6 lifters
Our DEV and TEST sets came from the 1 unseen lifter

NOTEWORTHY MODELS	DEV SET ACCURACY
BLSTM-50	73.0%
BLSTM-50 (with Rerack*)	78.3%
BLSTM-150 (with Rerack*)	96.5%
CONV-64 **BLSTM**-128 (with Rerack*)	97.6%

BLSTM-*k*: Bidirectional LSTM with *k* hidden units.
CONV-*k*: 1-D Convolutional Layer with *k* filters.
Rerack: Added one rerack label to each exercise to detect the rerack

TEST ACCURACY

98% Set Transcription
100% Exercise Recognition

Armed with our model, a smartwatch could **recognize**, **count** and **record** the exercises you perform during a workout – making it easier to stay on top of your fitness goals. With the appropriate data, our model could easily be extended to assess lifting form or track physical therapy prescriptions.

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