

N8 CIR INTERNSHIP 2026

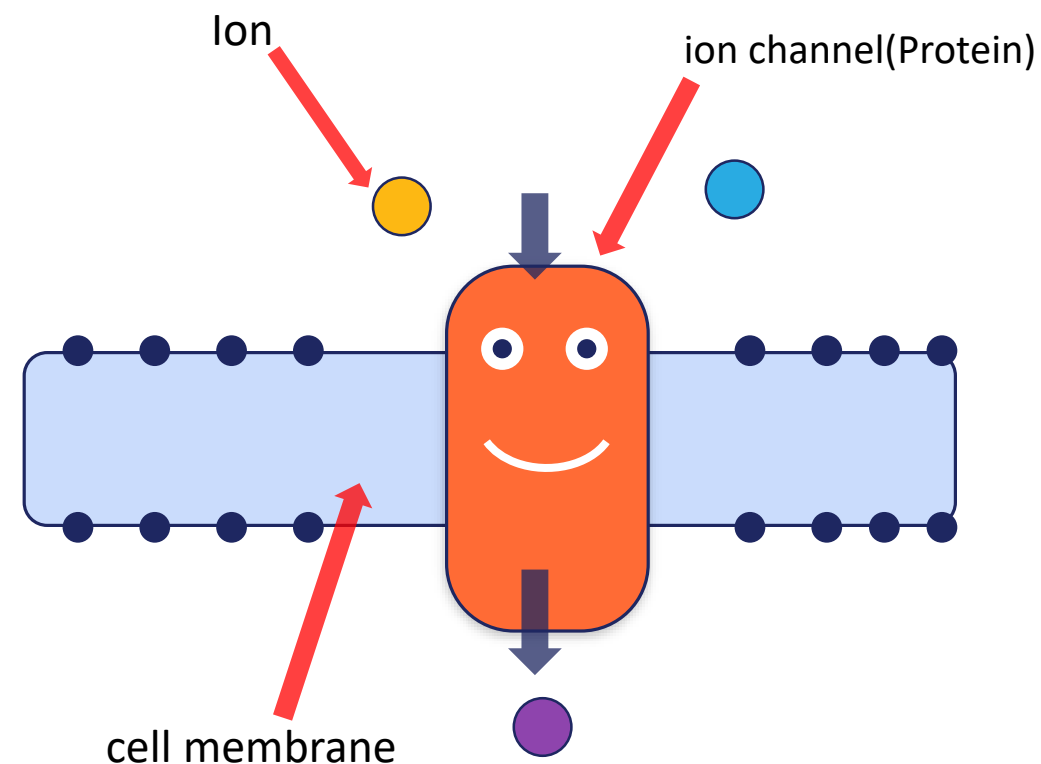
ChannelGate

Automatic Model Selection for Deep-Channel

[Deep-Channel](#): Celik et al., *Communications Biology* (2020)

Chengxu(Wendy) Jiang

Wendy.chengxu@gmail.com



Deep-Channel and Model Selection

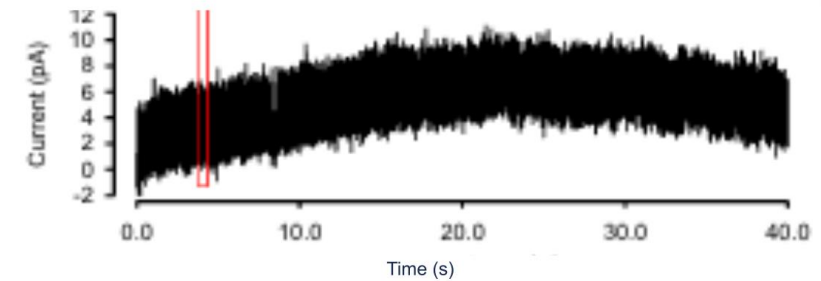
- Noise in electrical recordings makes channel openings difficult to identify.
- Deep-Channel uses AI to detect these openings automatically.
- Our current workflow offers several models; users choose which one to use.

Our goal: Automatically select a suitable Deep-Channel model for each recording.

How Deep-Channel reads a recording

Raw electrical recording

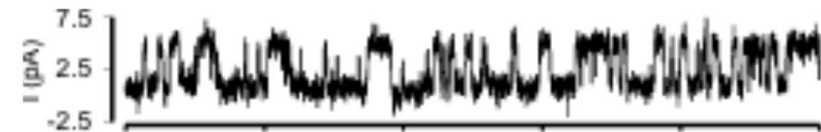
A long recording contains many rapid channel openings.



↓ Zoom in to see the detail

A short section of the same recording

0.5 seconds, enlarged for display



↓ Deep-Channel detects openings

Predicted open / closed states



Adapted from Celik et al., Communications Biology (2020), Fig. 6a,d,g · doi:10.1038/s42003-019-0729-3

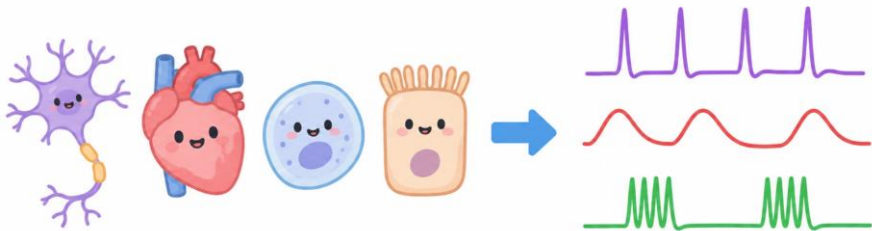
The Data

- Ion-channel recordings from Prof. Barrett-Jolley's group
- 8 Deep-Channel model groups, mainly **.parquet** files
- Continuous electrical current signals
- Large variation in file size and signal length
- Highly imbalanced across the 8 groups

10,066 files

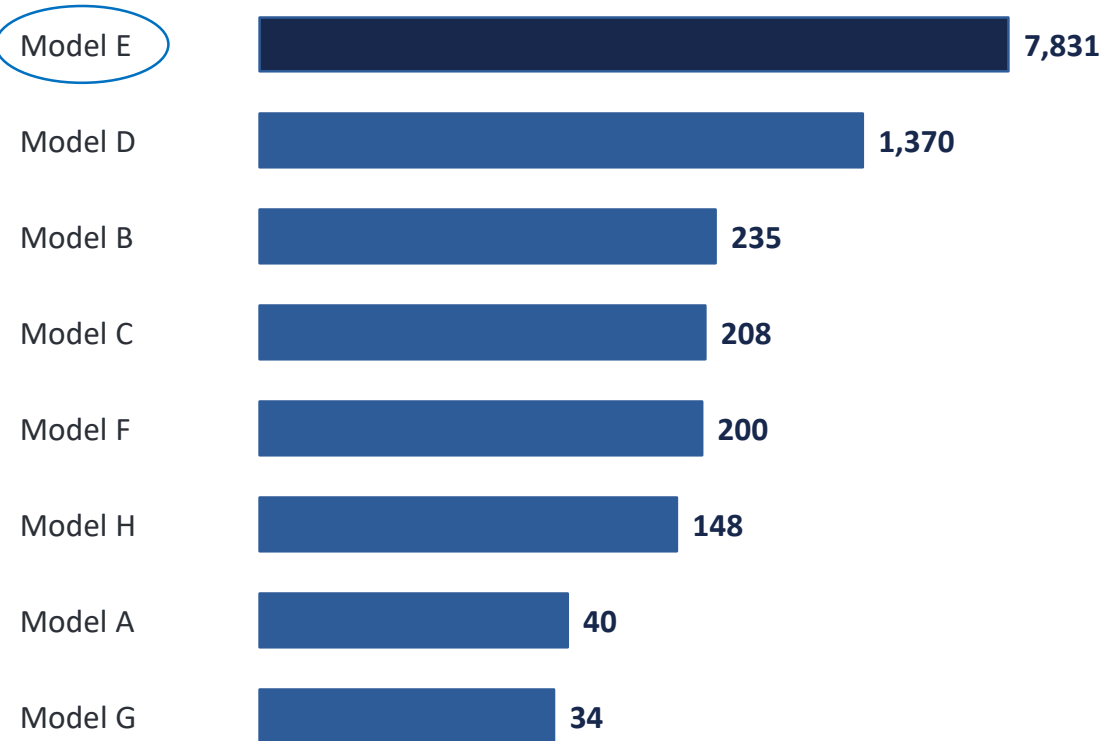
8 model groups

34–7,831 files per group



Different biological sources, different signal patterns

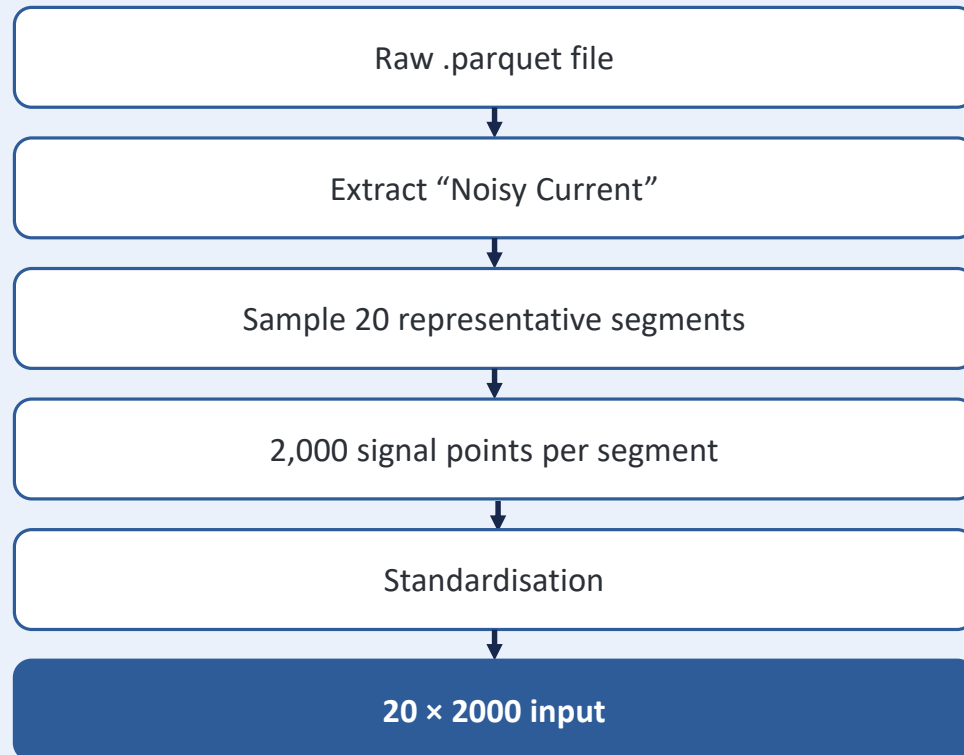
Files per Model Group (log scale)



The challenge was not only the volume of data, but making the training set representative and balanced.

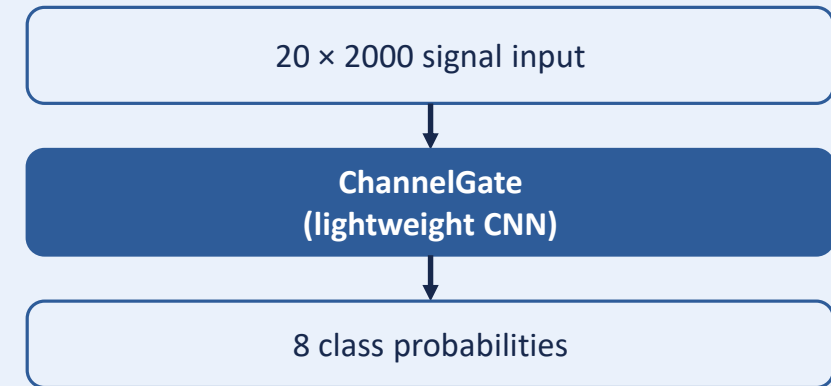
From Raw Signal to Model Selection

Preprocessing



Tools: Python · NumPy · Pandas · TensorFlow / Keras

ChannelGate Classifier



Example

Model B	← (Trained using data set Model B)	0.1%
Model A		0.2%
Model D		3.1%
Model E		96.4%

Recommended model: Model E

Training: balanced sampling · train / val / test split · early stopping · multiple seeds

Model Performance

96.7%

Correct Model Selection

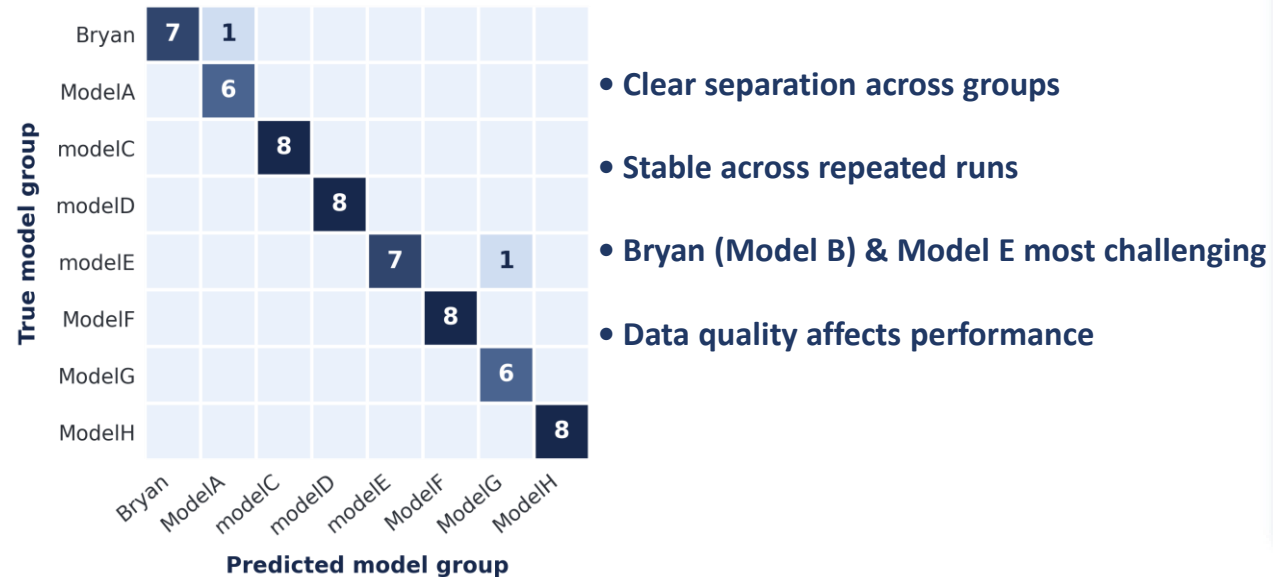
File-level test accuracy

0.964

Macro F1-score

Evaluated at file level — ChannelGate's goal is to route each entire input file to the most suitable Deep-Channel model.

Confusion matrix (independent test, n=60)



Interpretation & Integration

- Deep-Channel groups are not clear routing classes
- Model E is more varied, making it harder to classify
- Routing depends on clear model groups
- Integration issues include input shape and segment length

“ChannelGate can reliably route most files, but final performance depends on both clear model-group definitions and correct integration with the Deep-Channel pipeline.”

Demonstrating ChannelGate in Practice

The first step to the right model.

Select an existing ion-channel recording to recommend a downstream model before Deep-Channel analysis.

01 Recorded data **02 ChannelGate selection** 03 Deep-Channel analysis

Select an existing recording

Shared demo recordings · available on all devices

Model H · generated_data_0002.parquet · 8.5 MB

Refresh shared samples

8 shared recordings · visible on phone and computer.

► Administrator login · required to add or delete shared recordings

Choose a .parquet file from this device

Choose file No file selected

Choosing a file does not share it yet. After choosing its true class, use the shared-library button below.

True model class

Model H

Choose the known source class. Used only for comparison, not

Model recommendation

Recommended Model	Confidence
Model H	99.8%

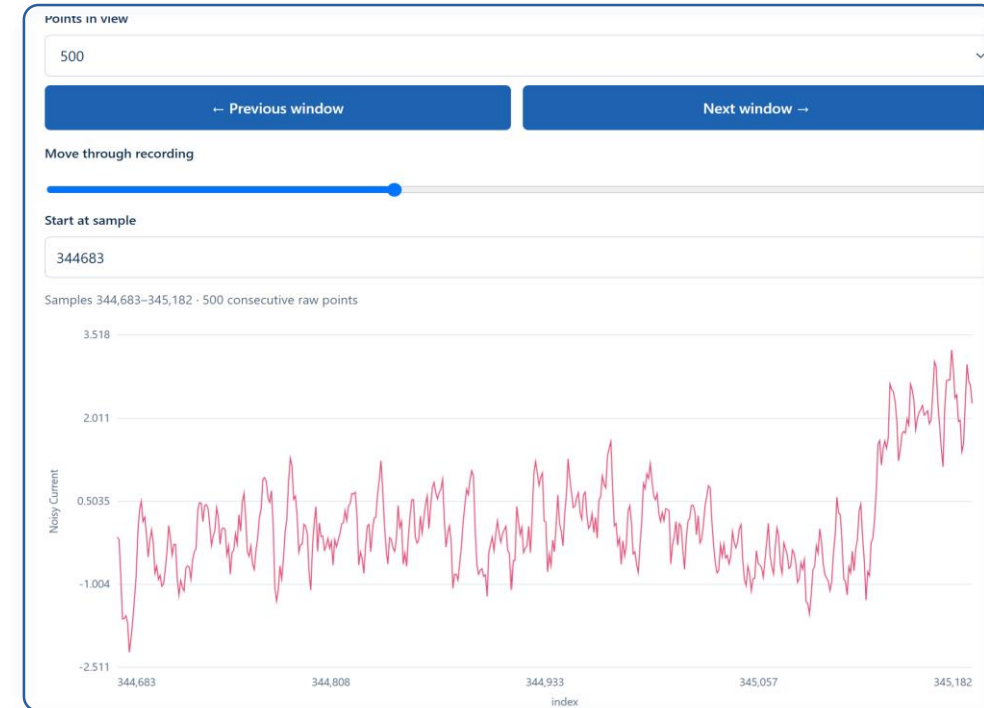
True class (user label): Model H · Match ✓

Class probabilities

Bryan		0.2%
Model A		0.0%
Model C		0.0%
Model D		0.0%
Model E		0.0%
Model F		0.0%
Model G		0.0%
Model H		99.8%

Confidence is the model's softmax score, not a guarantee of correctness.

- Select an ion-channel recording
- ChannelGate analyses the signal
- Receive the recommended model and confidence



Try ChannelGate
Scan to run a recording in your
browser
[ChannelGate · Model selection](#)

Conclusion & Future Work

What Was Achieved

- 8-class routing model
- Unified preprocessing
- Browser-ready deployment
- Automatic model recommendation

Next Steps

- Define clearer model groups
- Improve and retrain ChannelGate
- Integrate ChannelGate into Deep-Channel

“ChannelGate provides a practical first step towards automatic model routing in Deep-Channel.”

Thank you to Prof. Richard Barrett-Jolley, Dr. Benjamin, Dr. Antony, and the entire Deep-Channel team.

Questions?