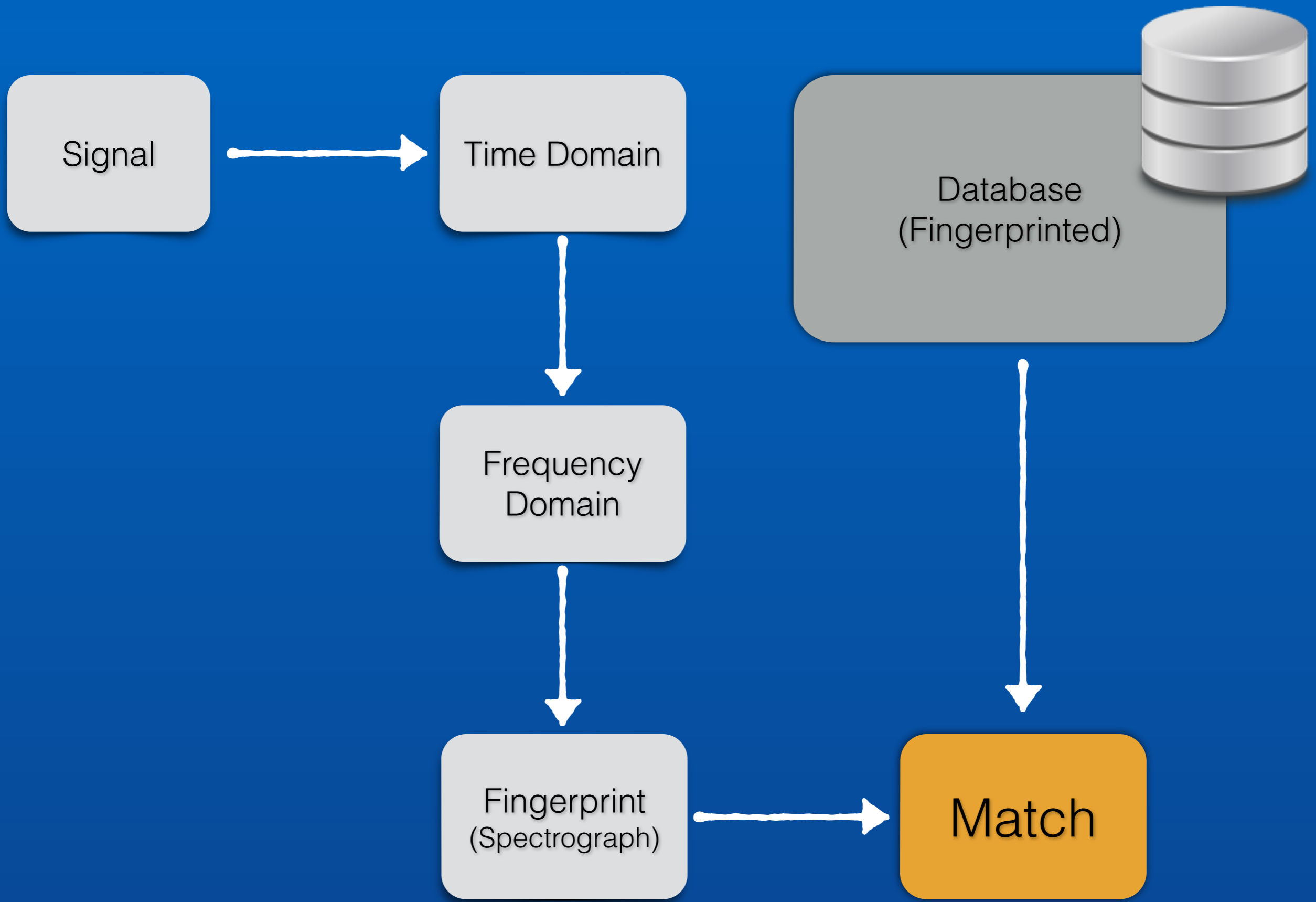
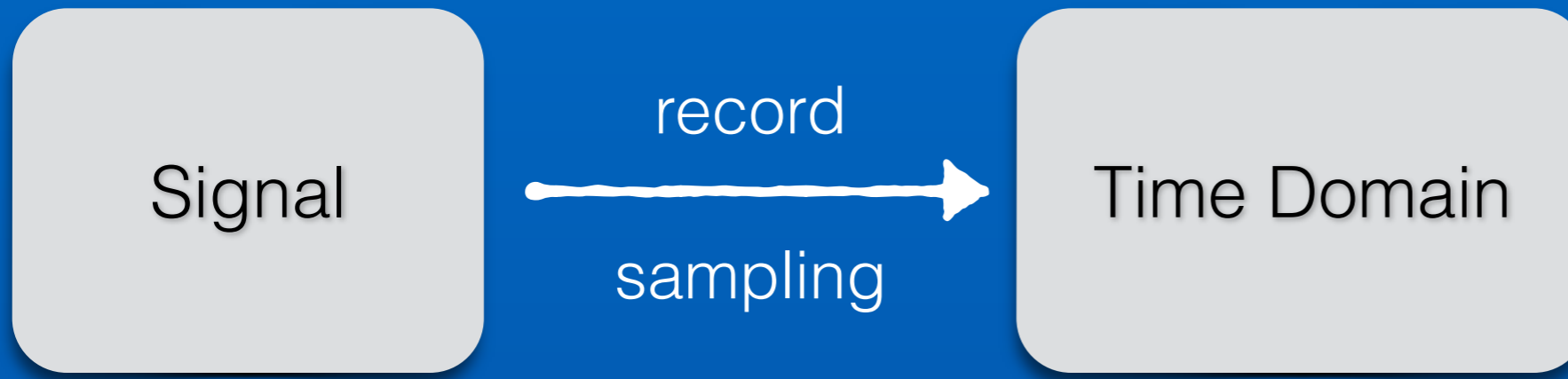


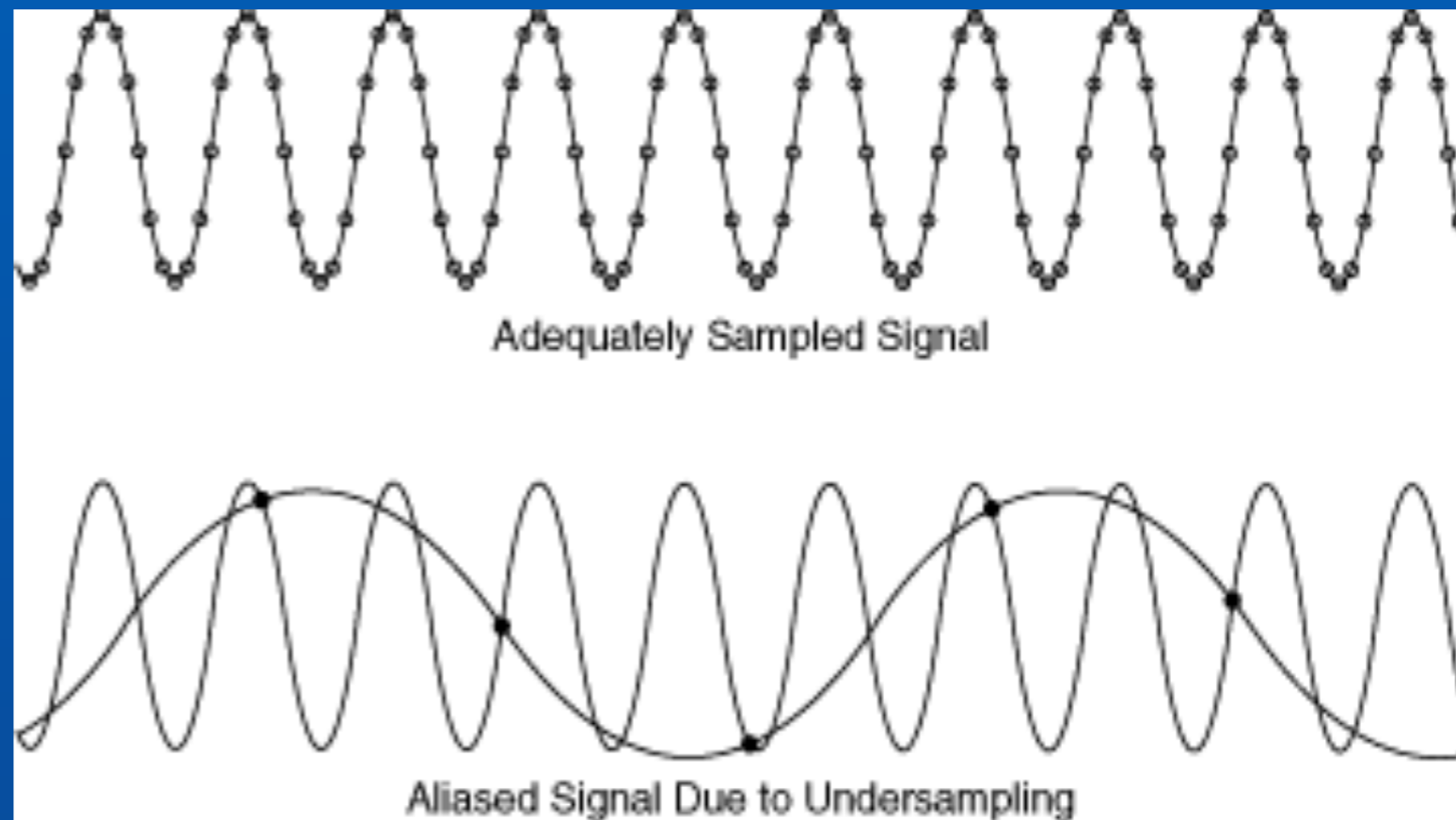


Jonathan Chen
Diana Gonzalez
Deborah Tonne





- Record as digital information
- Undersampling (aliasing)
- Sampled at Nyquist Rate to solve aliasing

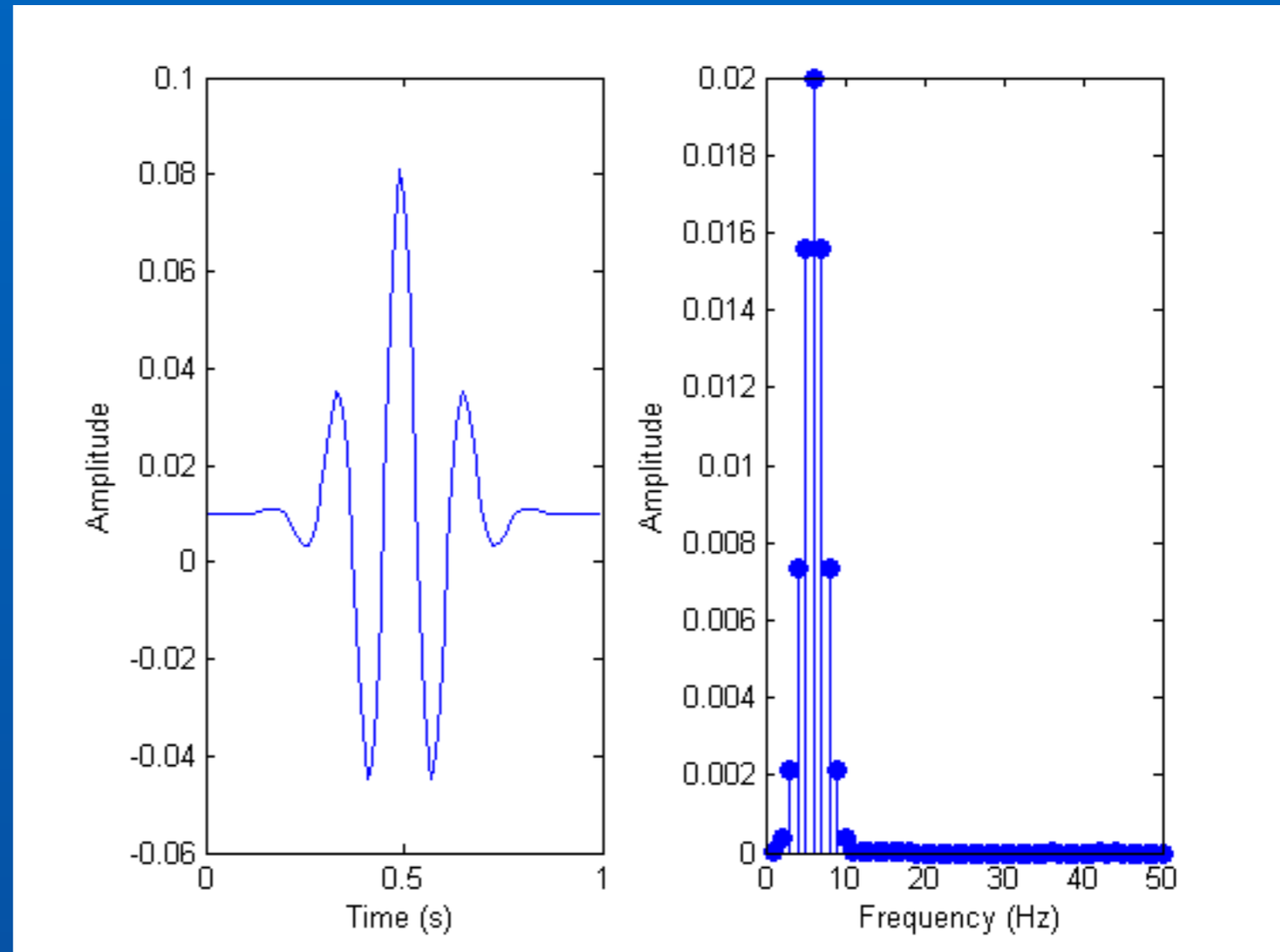


Time Domain

D
F
T



Frequency
Domain

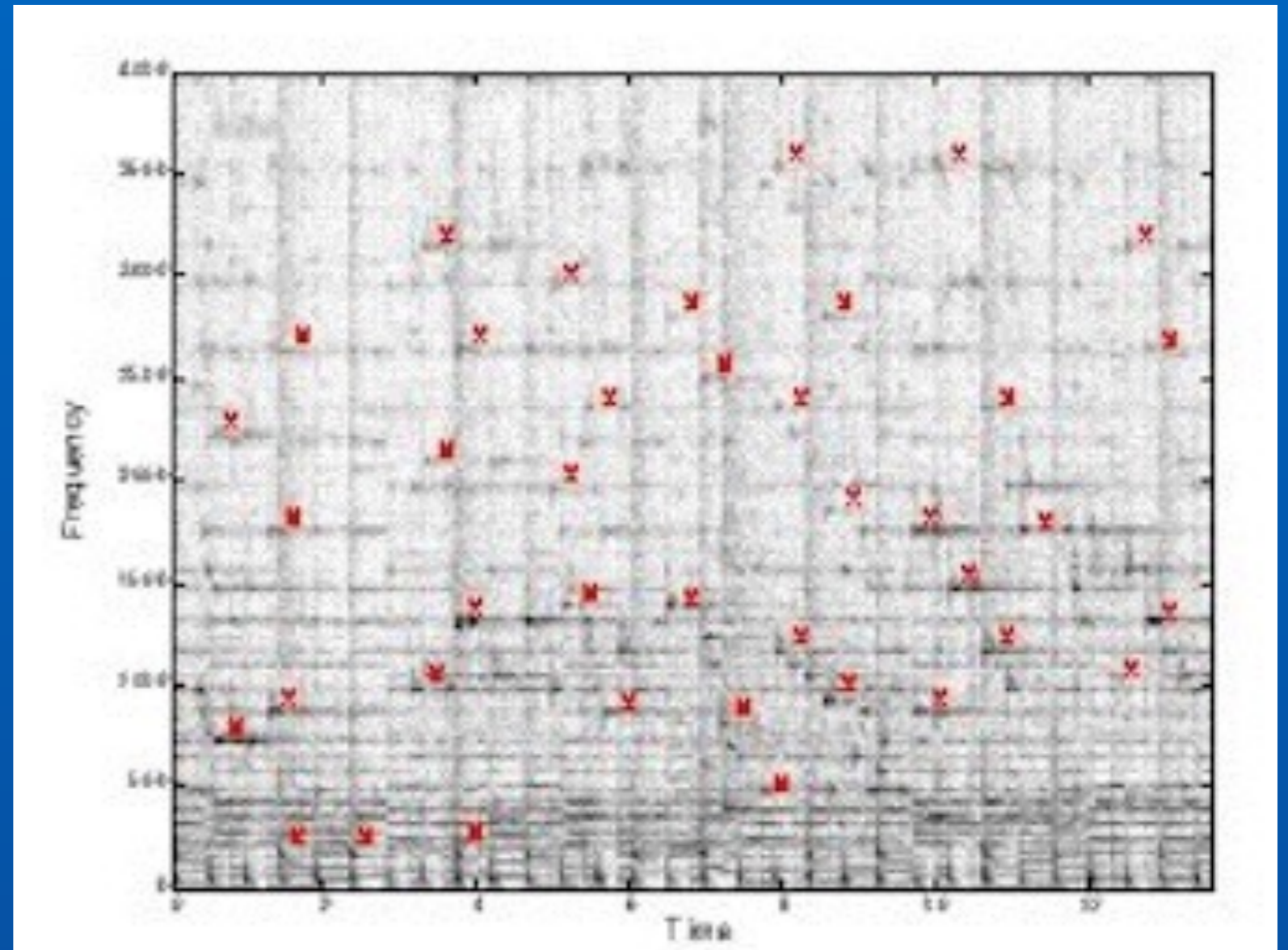


- FFT (Tukey and Cooley Algorithm)
- $O(n \cdot \log n)$ vs $O(n^2)$
- Uncertainty principle

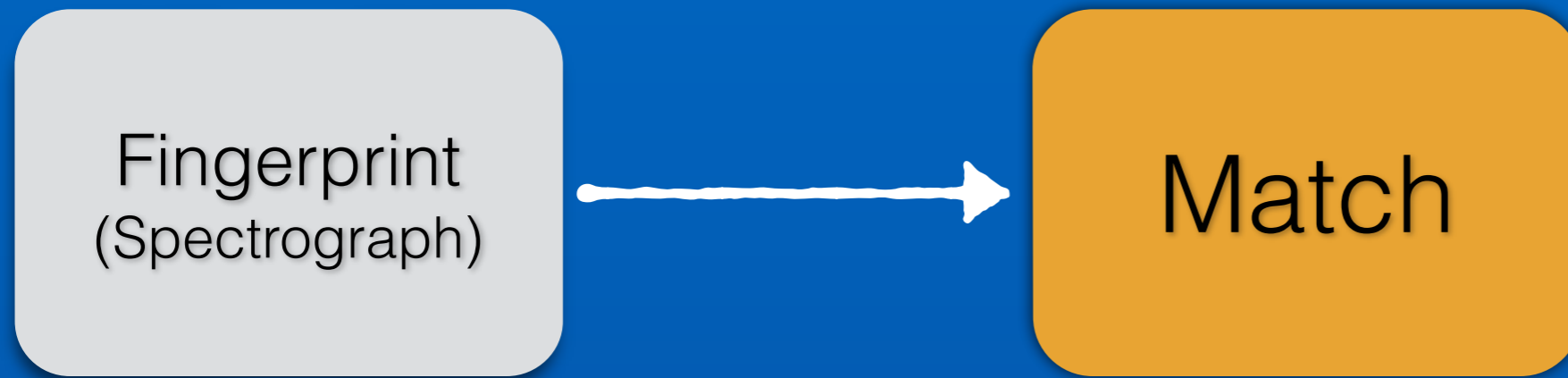
Frequency
Domain



Fingerprint
(Spectrograph)



Creates a hash table with time stamps



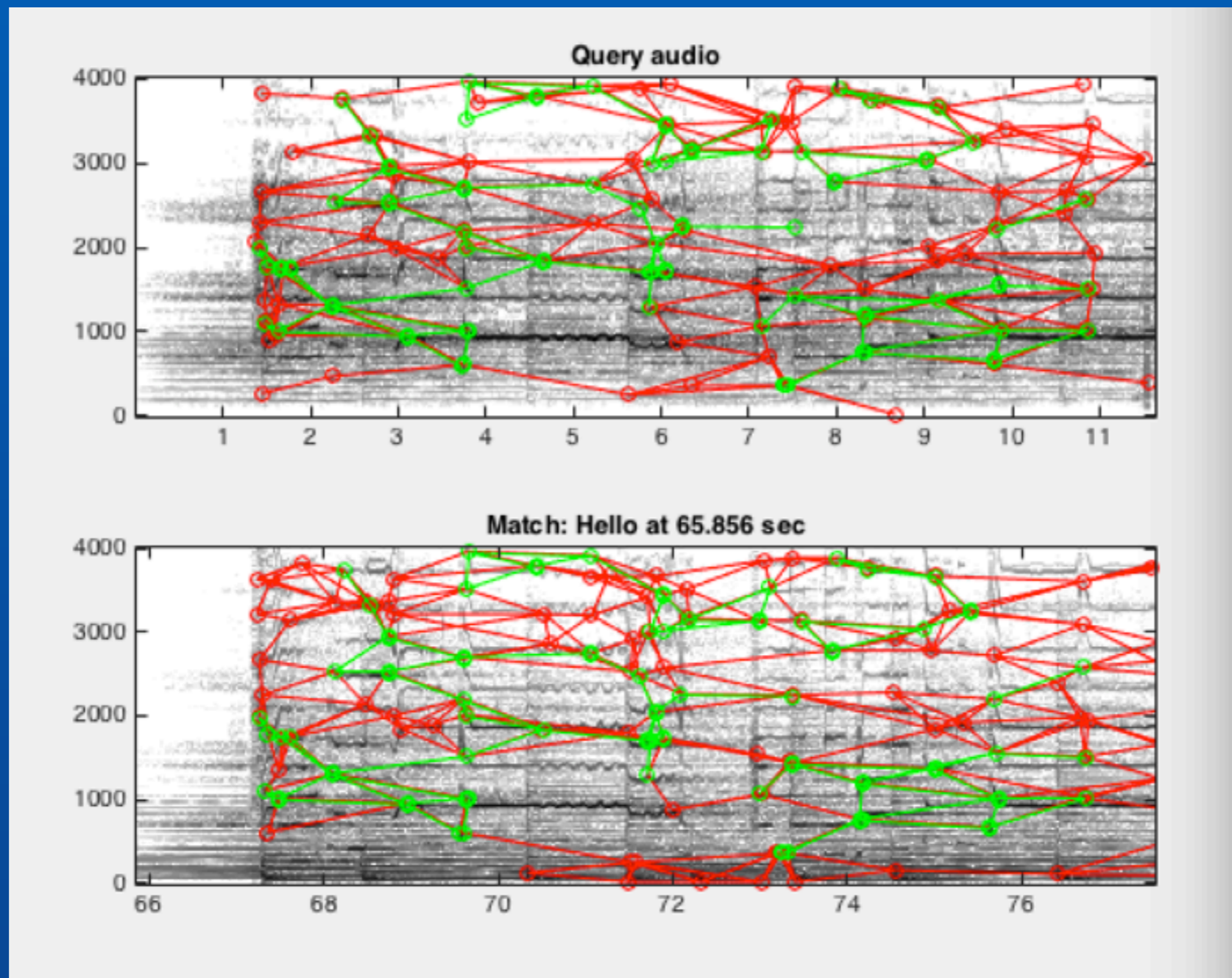
- Matching by hash table and difference in time stamps

Songs in our Data Base

1. *Chasing Pavements* by Adele
2. *Oops I Did It Again* by Britney Spears
3. *Hello* by Adele
4. *I'm a Slave 4 U* by Britney Spears
5. *Rolling in the Deep* by Adele
6. *Pictures of You* by The Last Goodnight
7. *You're Gonna Go Far Kid* by The Offspring
8. *She Will Be Loved* by Maroon 5

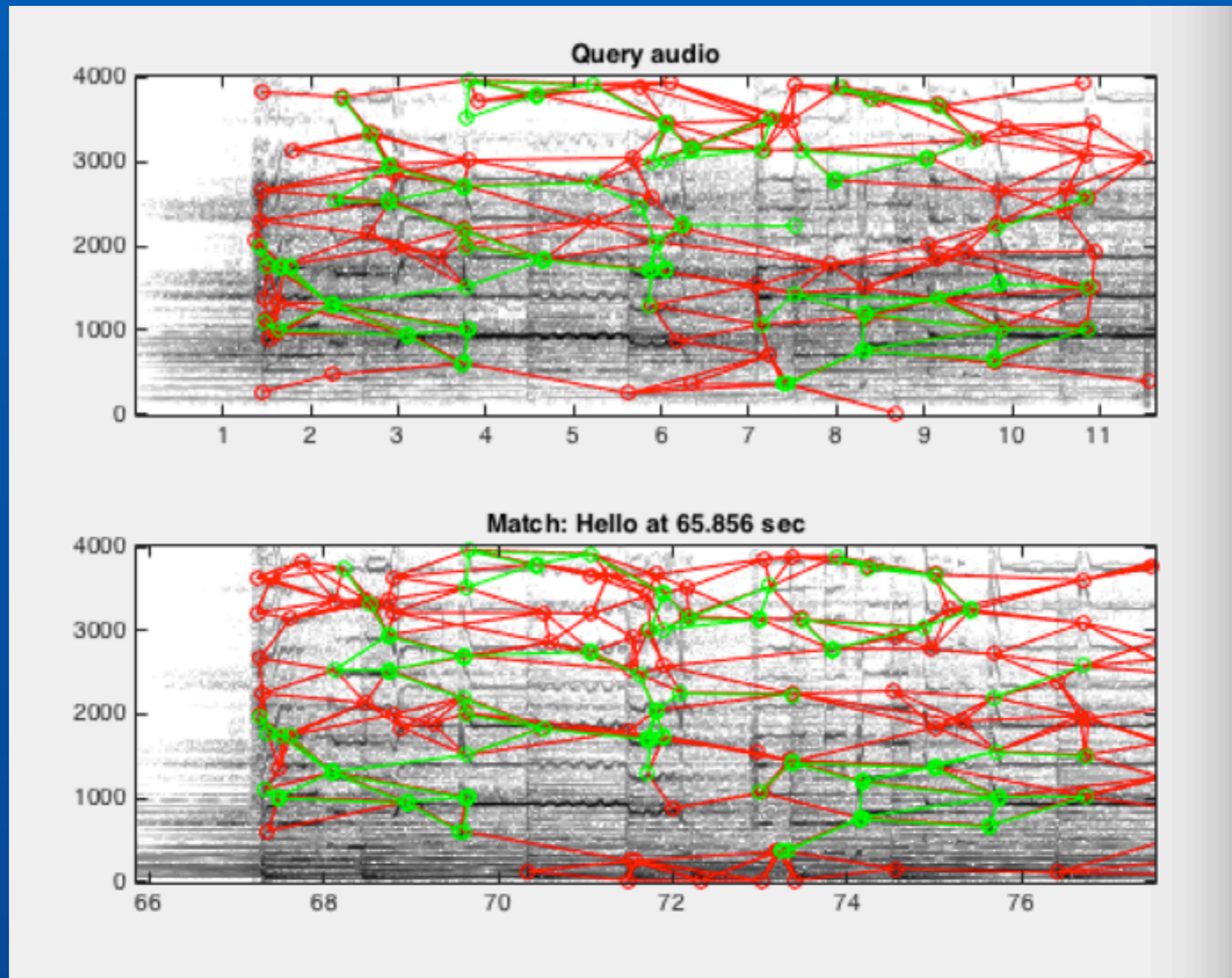
Hello by Adele

- Matched a segment *Hello* to the actual song.
- It converged to *Hello* with 94 matches



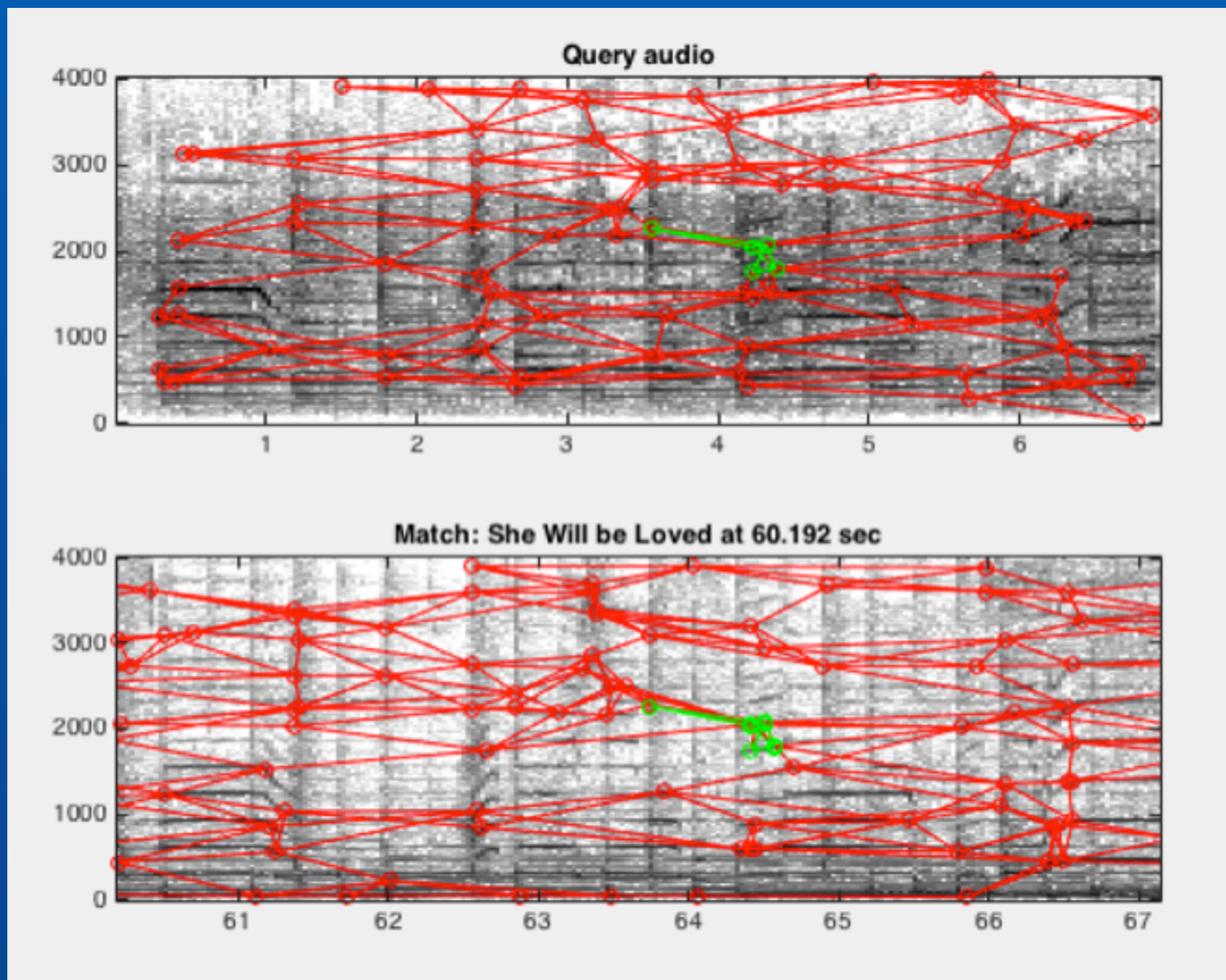
Hello by Adele

- Matched a segment *Hello* to the actual song.
- It converged to *Hello* with 94 matches



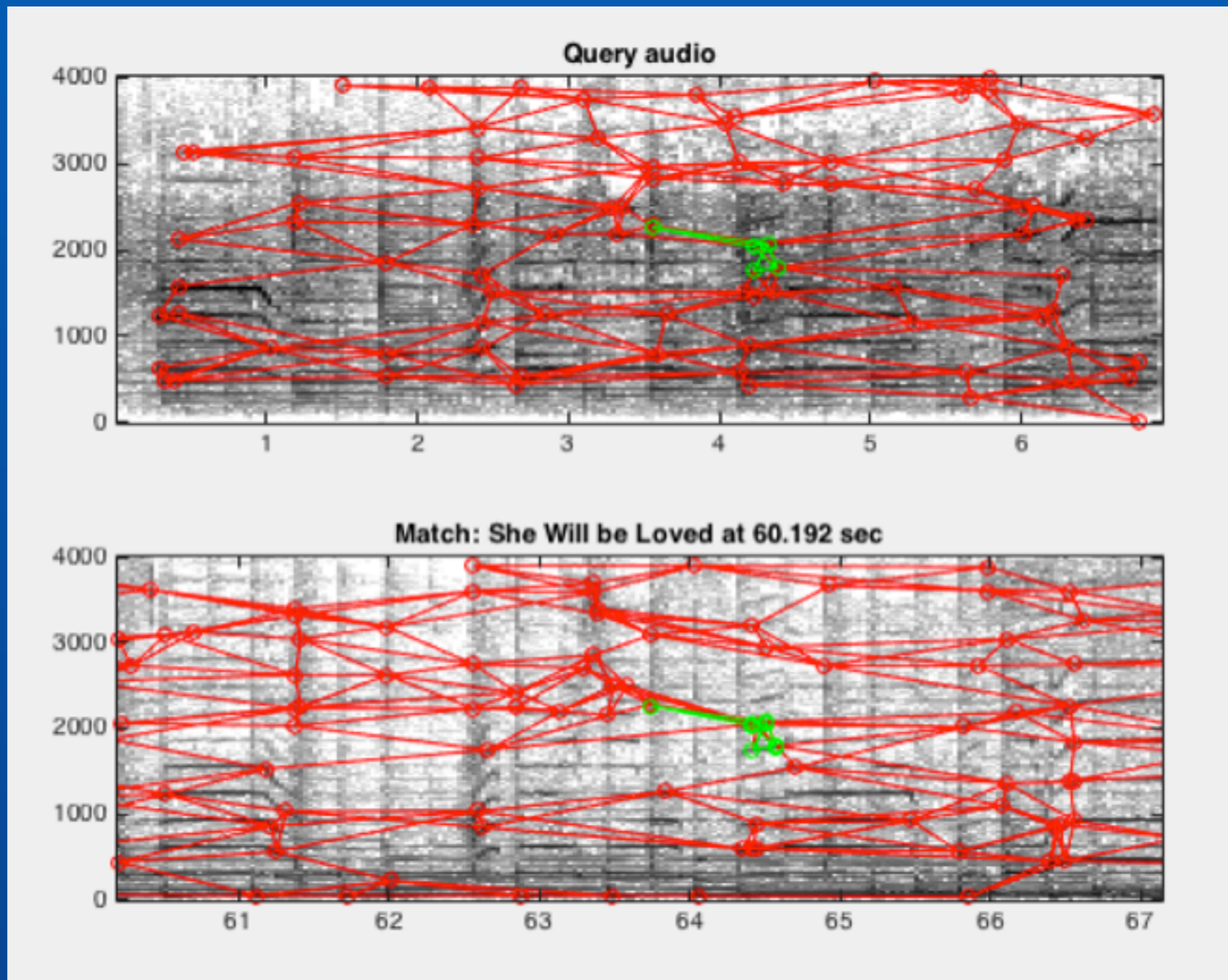
She Will be Loved by Maroon 5

- Matched a segment of a remix of *She Will be Loved*
 - Main audio remained the same
- It converged to *She Will be Loved* with 10 matches



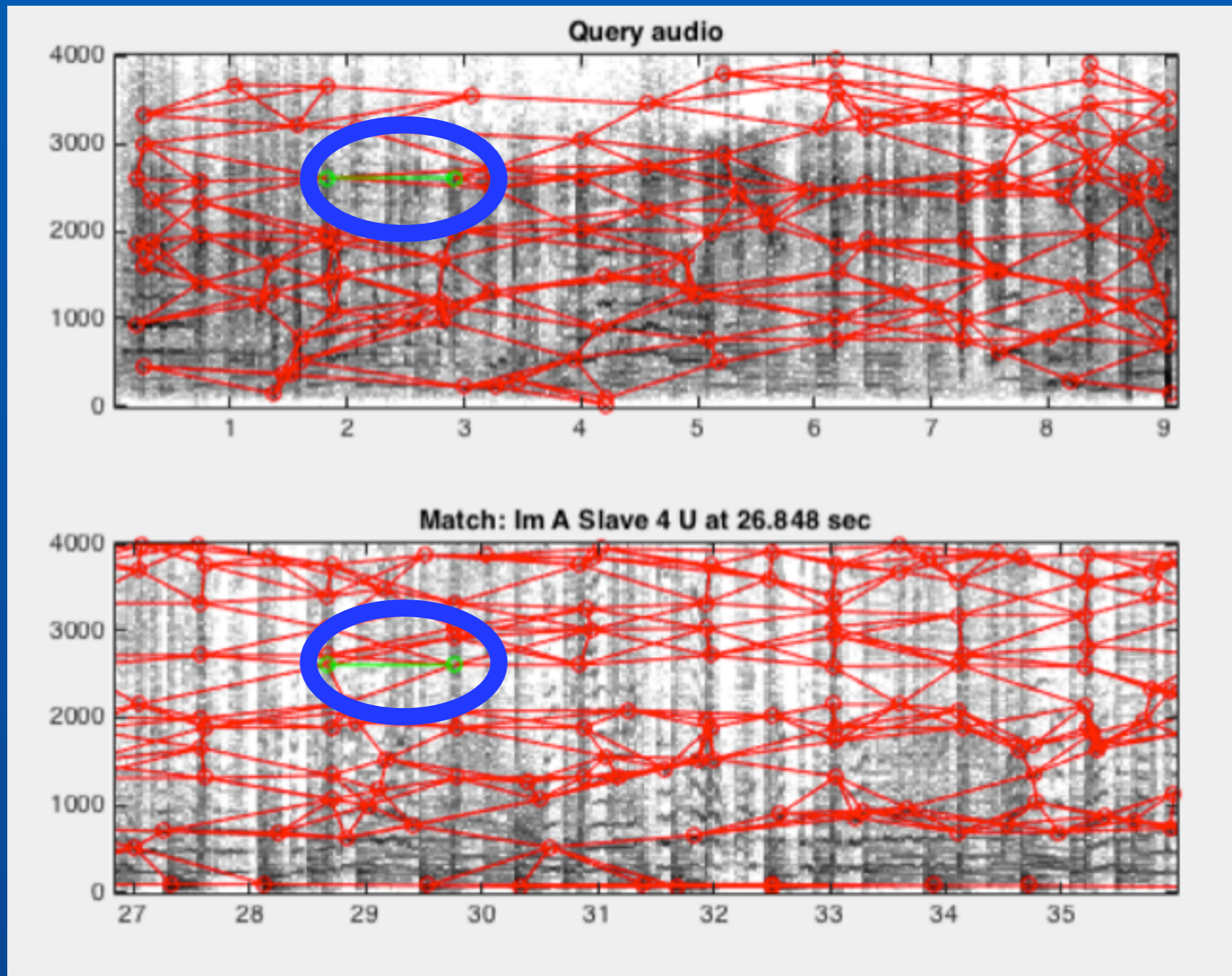
She Will be Loved by Maroon 5

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 - Main audio remained the same
- It converged to *She Will be Loved* with 10 matches



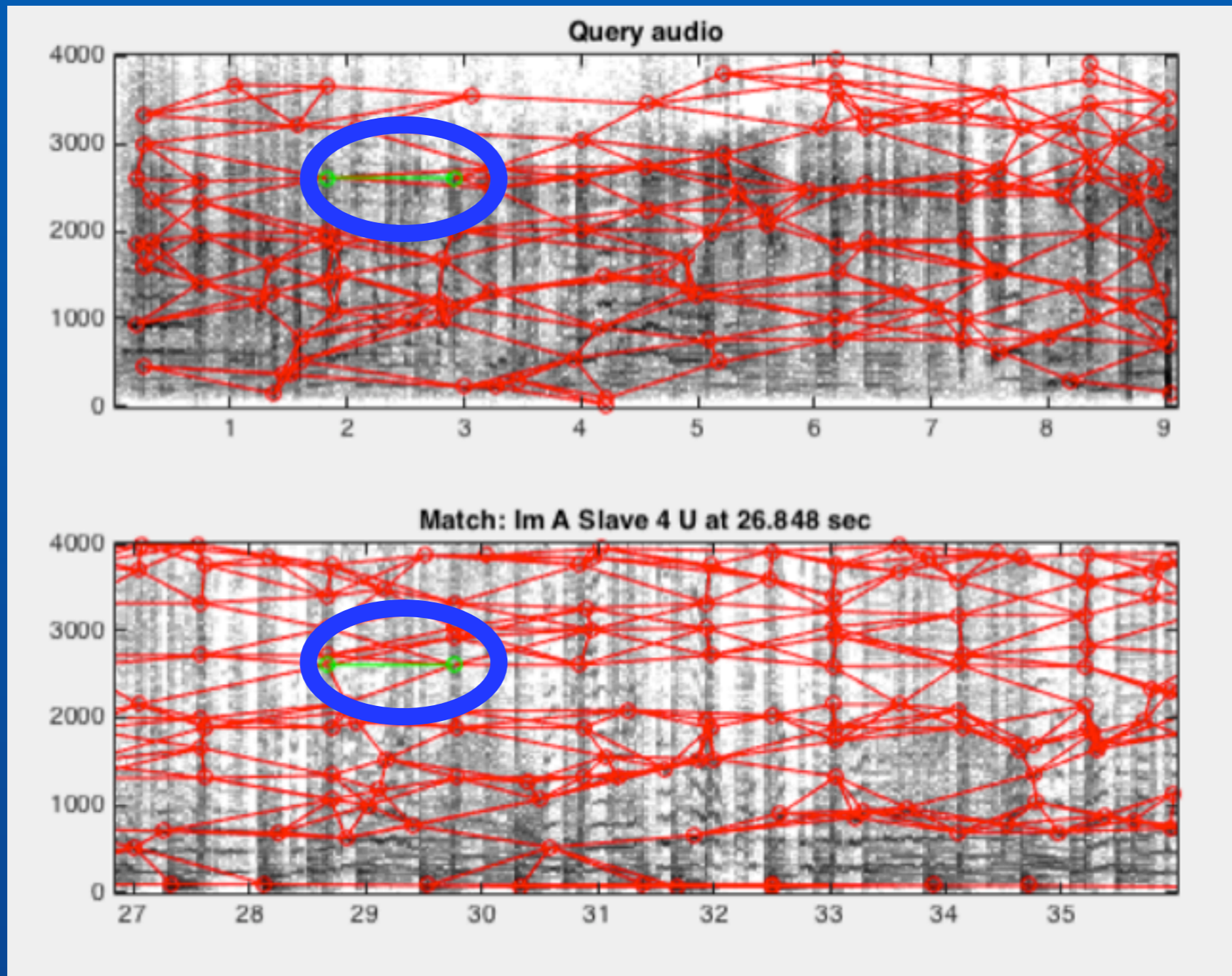
I'm a Slave 4 U by Britney Spears

- Matched a segment of a Glee Cover
 - Notes and background were similar
- It converged to *I'm a Slave 4 U* with 3 matches



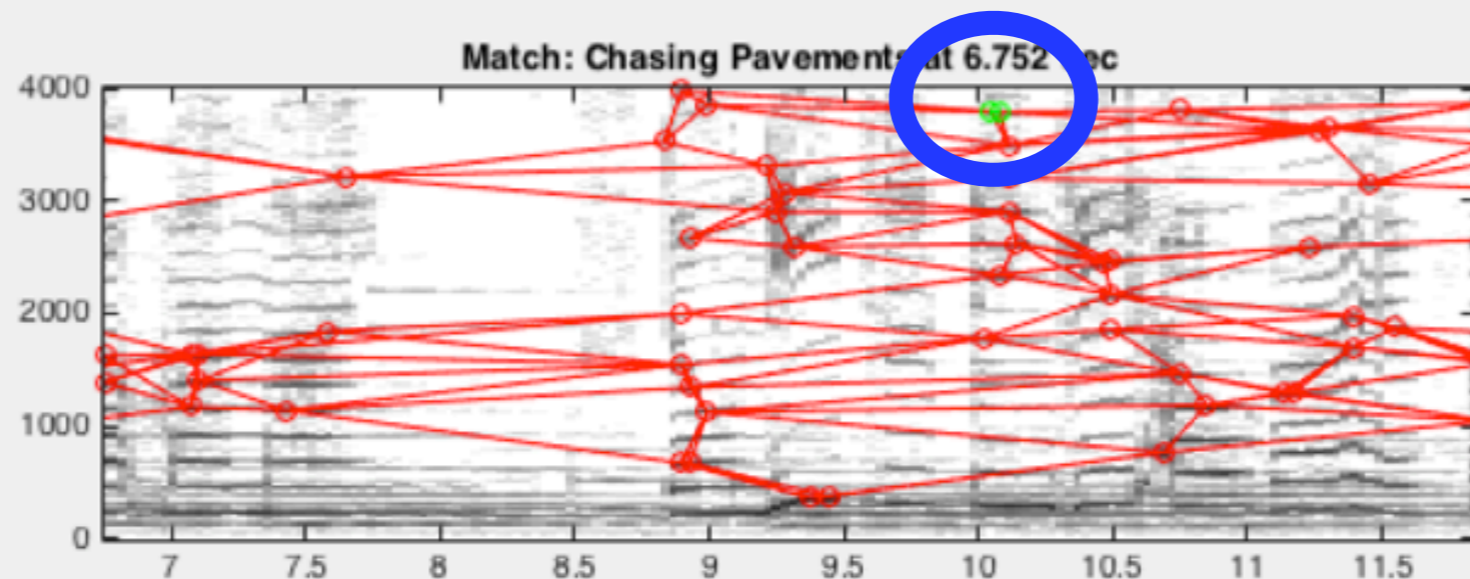
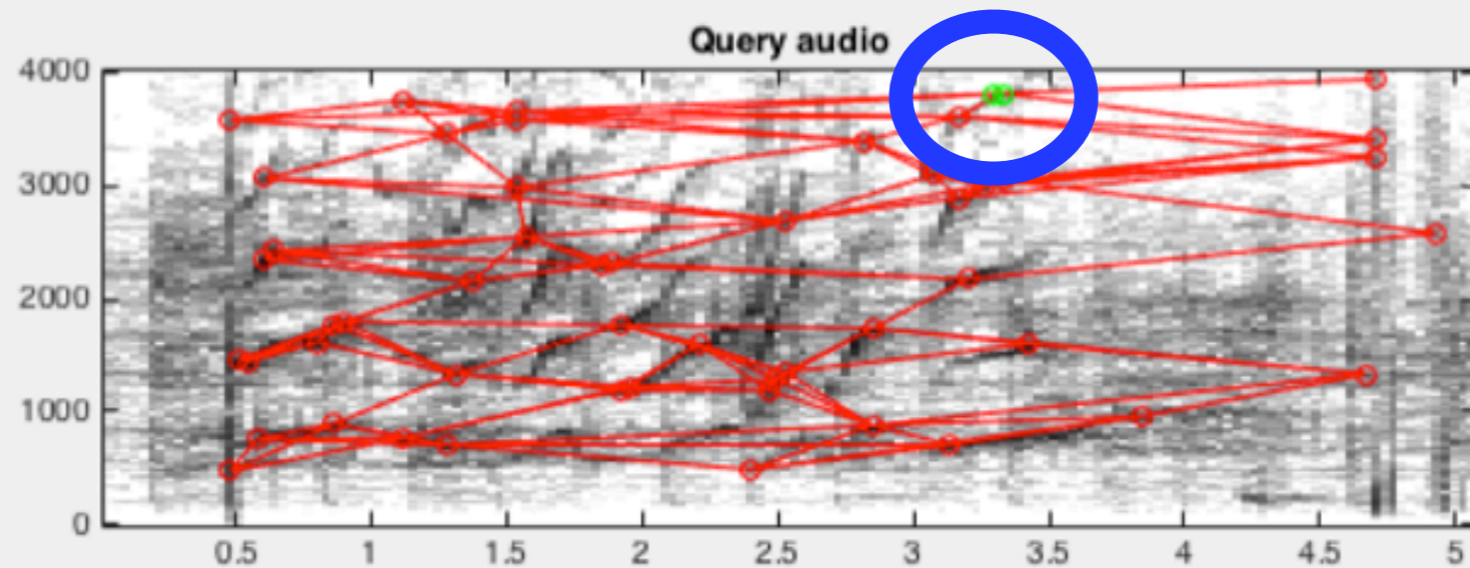
I'm a Slave 4 U by Britney Spears

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 - Notes and background were similar
- It converged to *I'm a Slave 4 U* with 3 matches



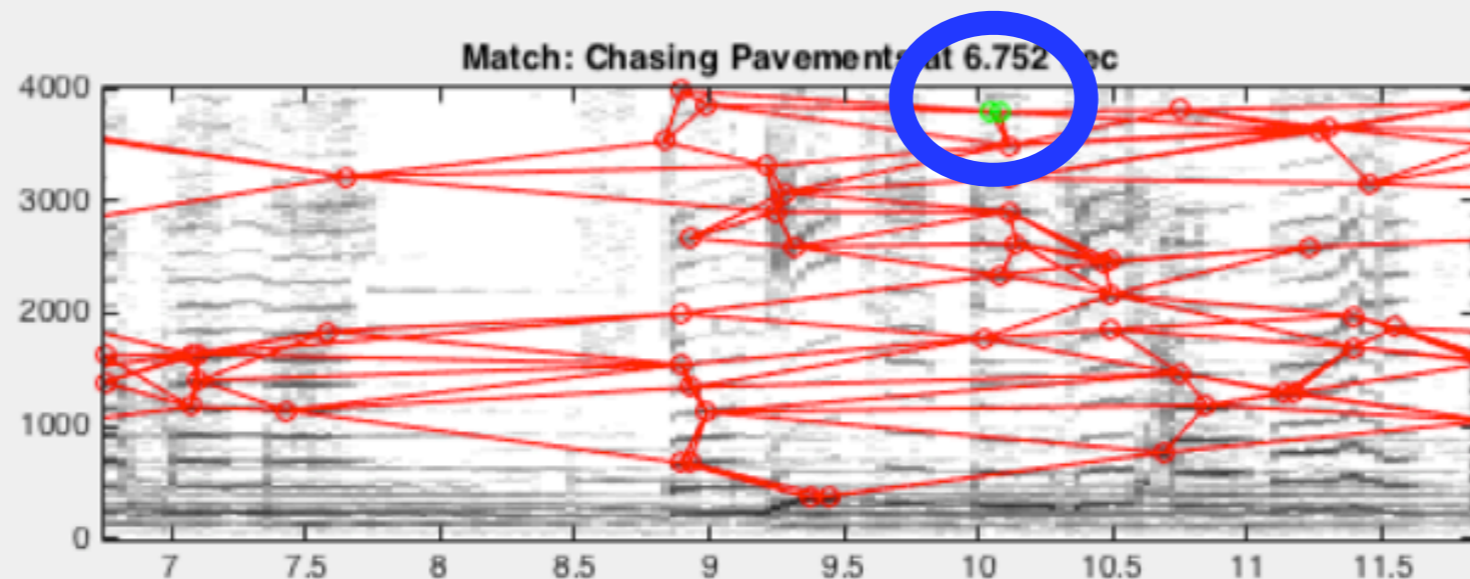
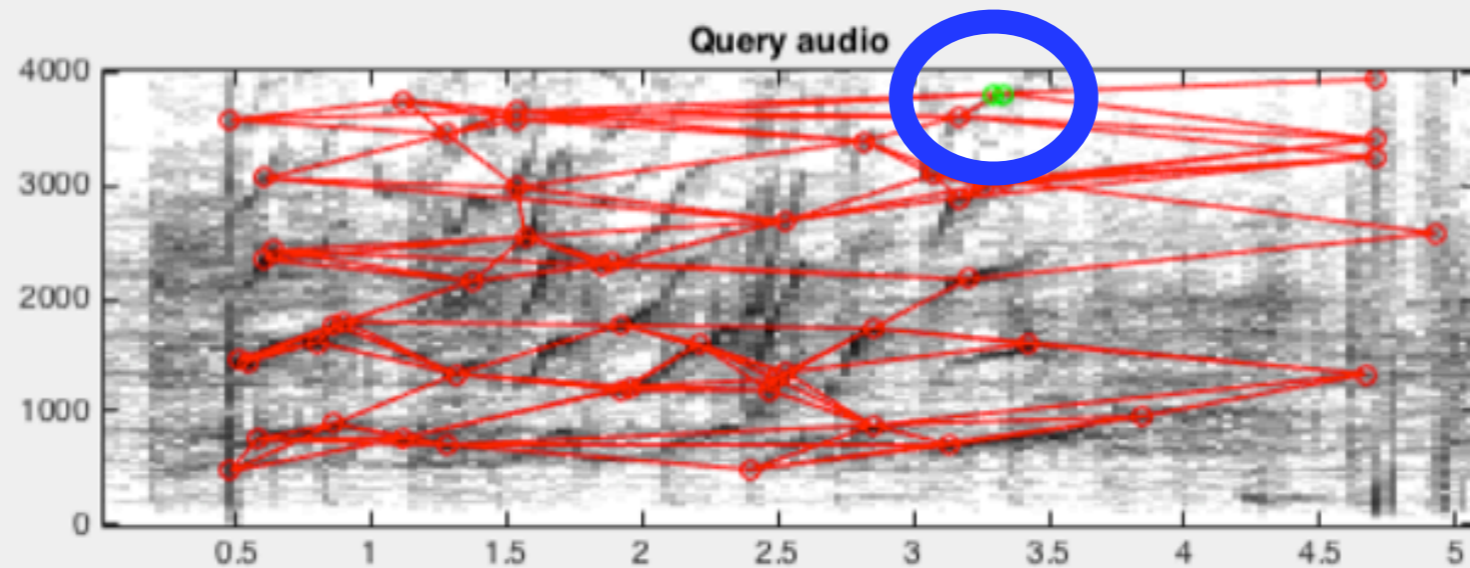
Oops I Did It Again by Britney Spears

- Matched a segment of the original song with noise
 - Debbie's voice is at a higher intensity
- It converged to *Chasing Pavements* by Adele with 2 matches.



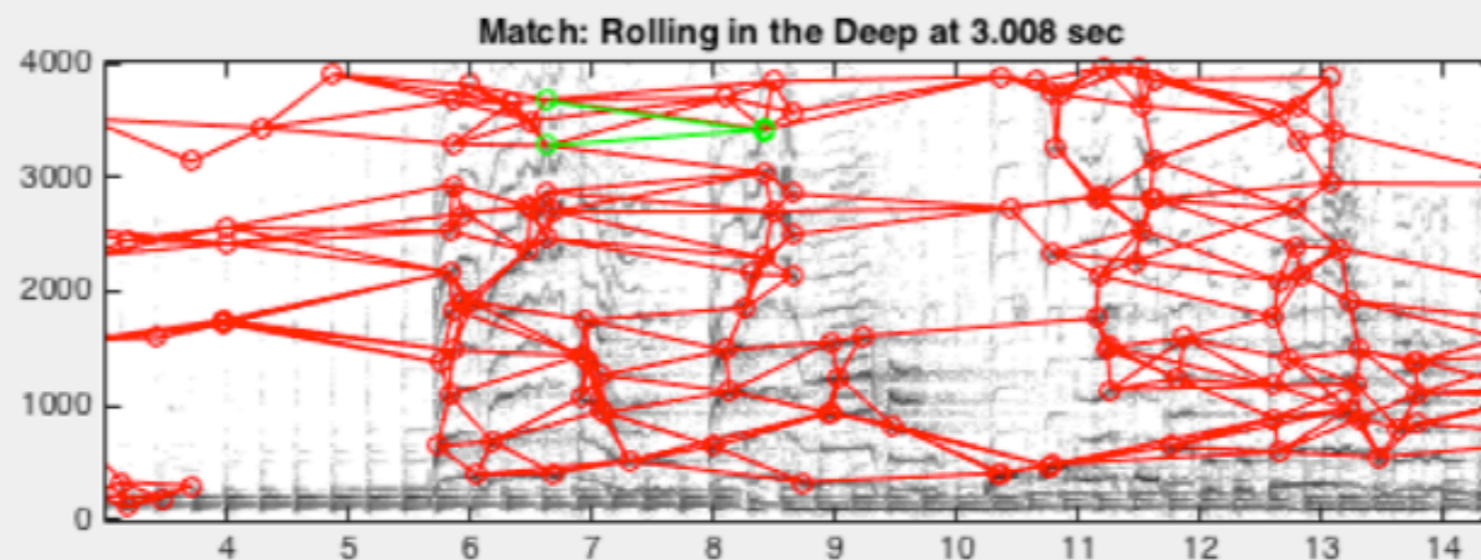
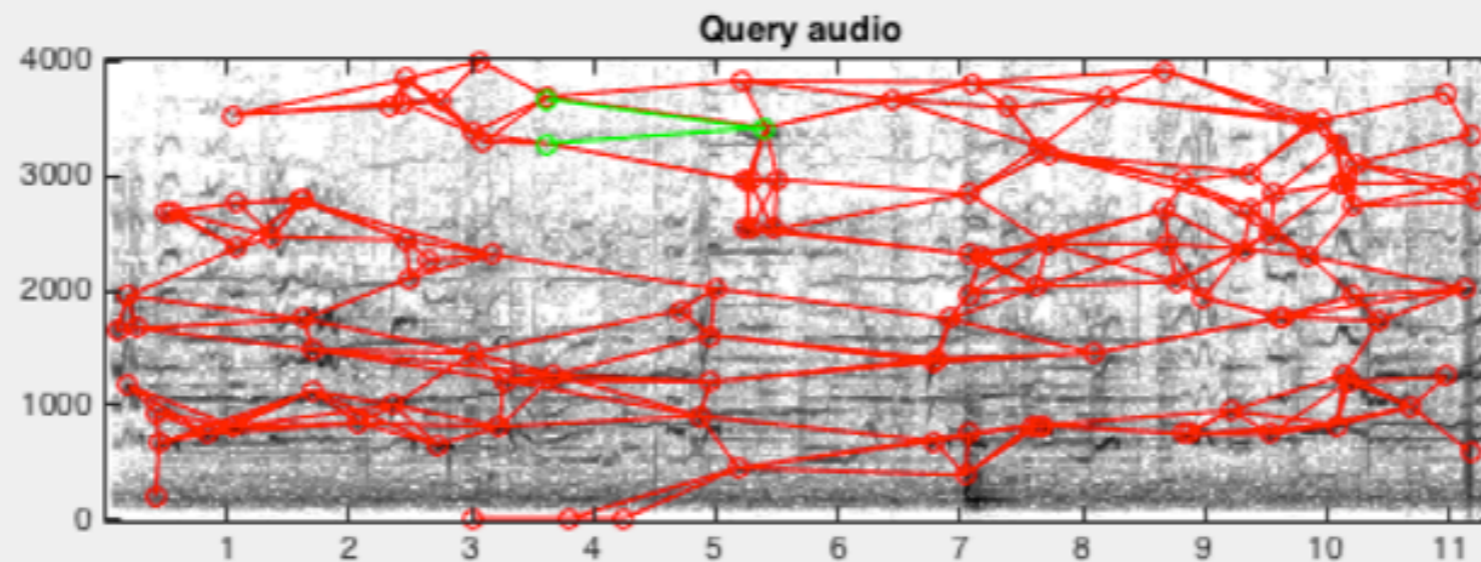
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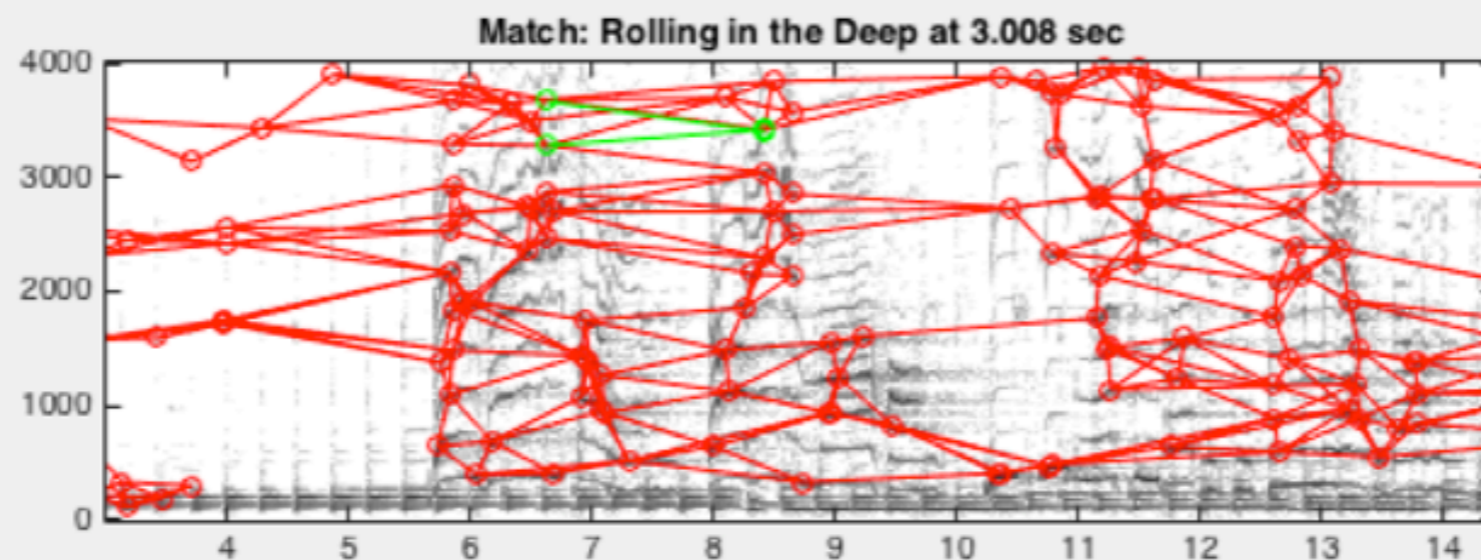
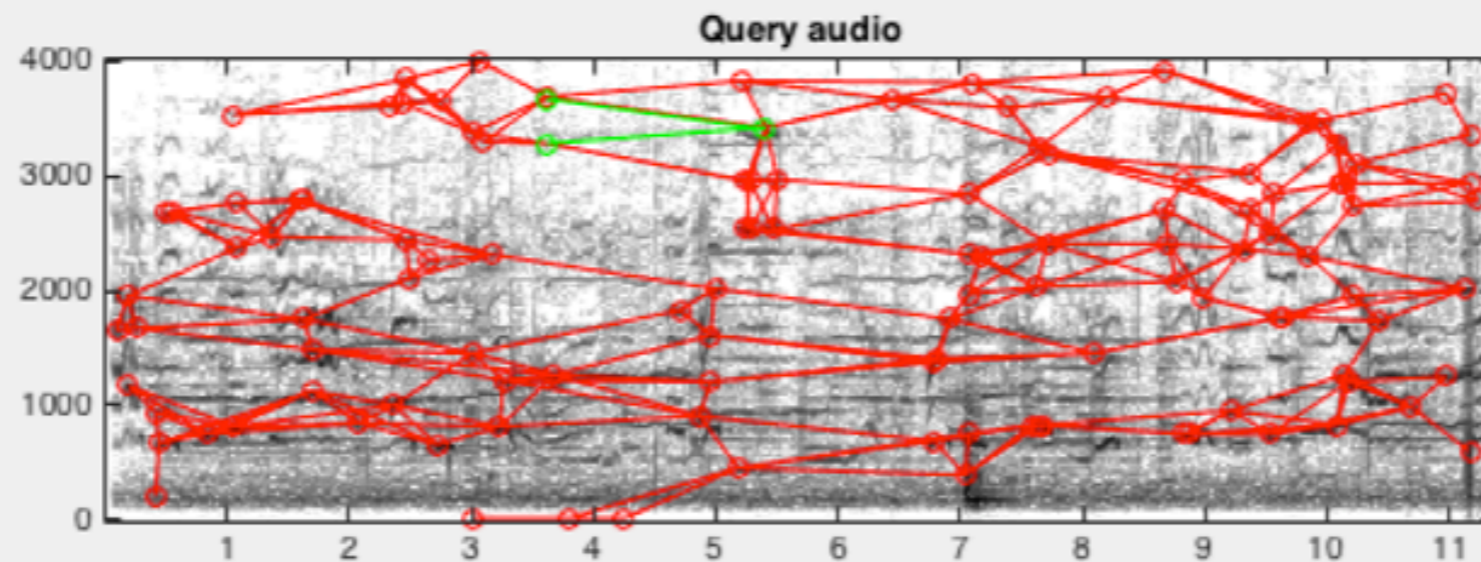
Oops I Did It Again by Britney Spears

- Matched a segment of a cover.
 - Intensity and frequencies differ from original.
- It converged to *Rolling in the Deep* by Adele with 3 matches.



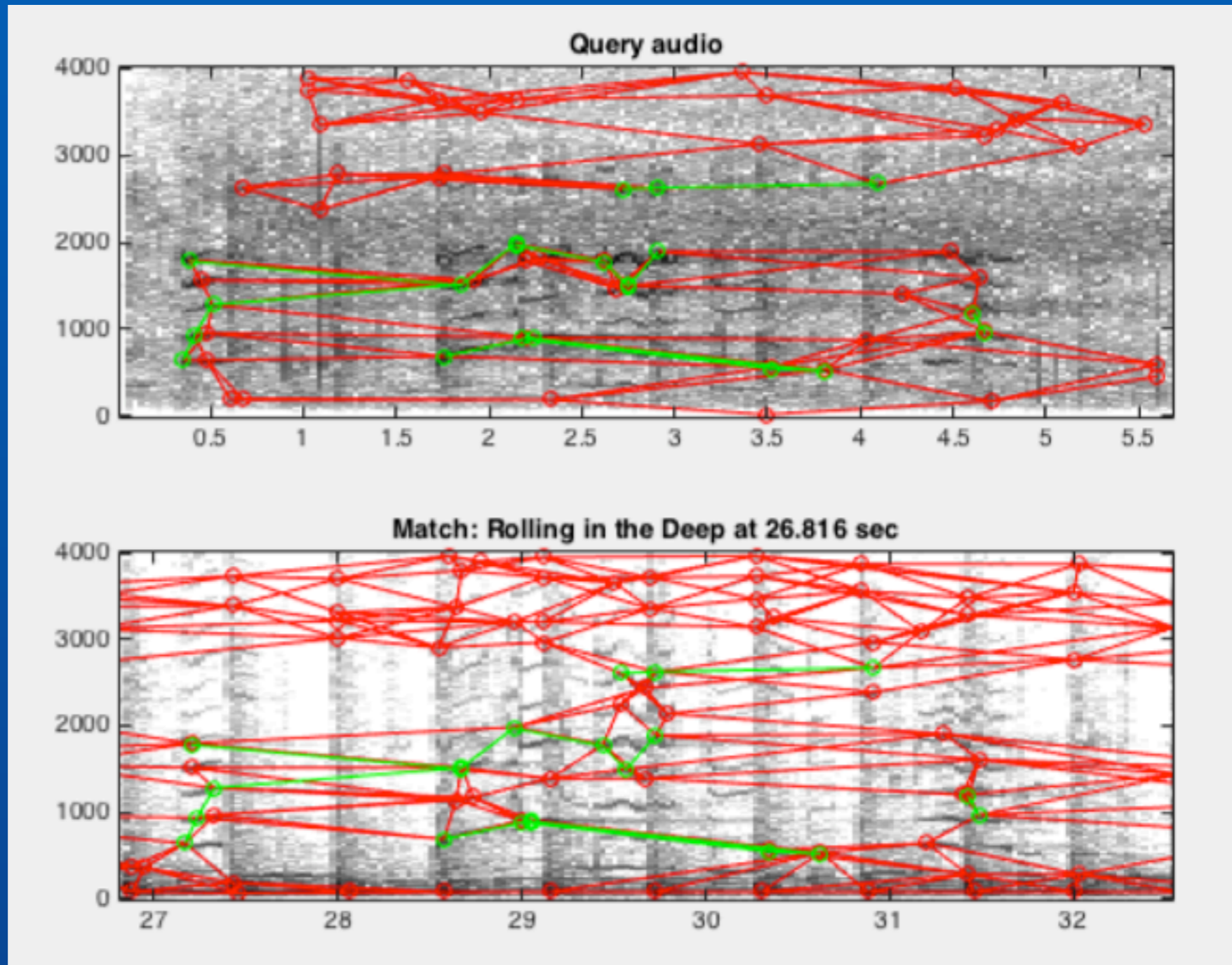
Oops I Did It Again by Britney Spears

- Matched a segment of a cover.
 - Intensity and frequencies differ from original.
- It converged to *Rolling in the Deep* by Adele with 3 matches.



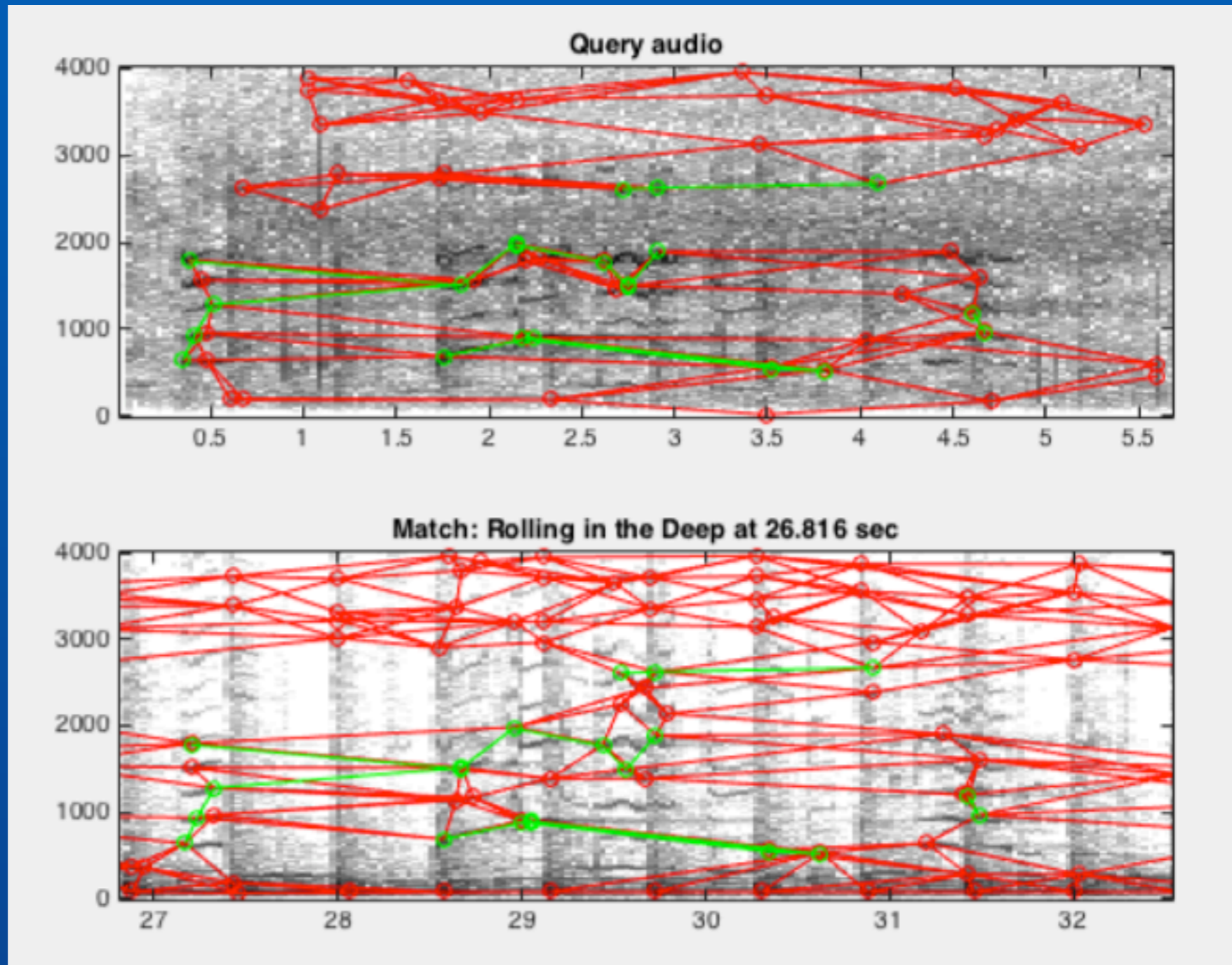
Rolling in the Deep by Adele

- Matched a segment of the original song with static.
- It converged to *Rolling in the Deep* with 19 matches.



Rolling in the Deep by Adele

- Matched a segment of the original song with static.
- It converged to *Rolling in the Deep* with 19 matches.



Analysis

- Number of matches can vary with song length
- Songs are matched correctly if enough high intensities and time differences match
- Code forces demoed songs to converge to a song in our database
- More likely to match similar songs due to small database

References

- Shazam Code adapted from Dan Ellis
- <http://www.toptal.com/algorithms/shazam-it-music-processing-fingerprinting-and-recognition>
- <http://labrosa.ee.columbia.edu/matlab/fingerprint/>
- <https://www.princeton.edu/~cuff/ele201/files/lab2.pdf>

