Project Abstract

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Abstract

Research Question

Does bladder pressure data (bladder pressure during filling and voiding pressure peaks) possess distinct features that are indicative of Voiding Efficiency and/or other Lower Urinary Tract physiologic variables (such as anesthetized urethra) in rats?
The Urinary bladder experiences changes in internal pressure during filling and voiding cycles. During voiding, pressure peaks with increased duration are observed in bladder pressure data.
The research question proposes a project that will code pressure peaks into predetermined feature spaces based on variables such as peak height, peak duration, area under peak curve, and mean pressure.
In addition, the project will design classification algorithms that automatically identifies important features in voiding and filling phases of bladder pressure data. These features will then be used to answer the above question.

Significance

Cystometry, a Urodynamic test of urinary bladder function, measures the pressure in the bladder during artificial infusion of saline and natural voiding in living organisms (rats).
The pressure data collected shows information only on the contraction ability of the bladder during filling and voiding. The research question seeks to use the pressure data to identify other variables associated with the Lower Urinary Tract (LUT) function. Mainly, the question seeks to quantify (or qualify) Voiding Efficiency in rats.
Voiding Efficiency, VE, is a measure of how well the bladder empties itself. This variable is an important diagnostic tool in assessing Urinary Tract function as a low Voiding Efficiency can be indicative of some underlying LUT disorder as well as a predictor of future LUT disease, for instance infection.
In addition to VE, the project intends to classify rats with lidocaine-anesthetized urethras from rats without. Answering these question will allow bladder pressure data to be used widely for assessing LUT function, diagnosing LUT disorders, and verifying LUT treatment methods.

Data set

The data to be used for this project consists of two groups *(N: normal; L: Lidocaine)* of time series data of bladder pressure collected during cystometric experiments on Urethane-anesthetized female rats in the Applied Neural Interfaces Lab.
The two groups of data are different in that one was collected after Lidocaine was used to anesthetize the rat urethra. For each rat, 3 normal experiments corresponding to 3 saline infusion rates were conducted and 3 lidocaine experiments using the same infusion rates were conducted, i.e., a total of 6 experiments per rat. The rat voided 3-4 times for each experiment.
Other relevant information about the data set are presented in the table below for each experiment.

Surgical Protocol Review	Institutional Animal Care and Use Committee at FIU
Software	LabChart; MATLAB
File Format	MATLAB Struct (.mat)
File size	< 1 MB
Duration	20 - 40 minutes
Signal Information	
Number of channels	1
Bladder Pressure	mmHg
Time	Recorded in seconds
Sampling rate	100 Hz