IEEE VIS 2016 Tutorial Proposal

Jun Tao, Hanqi Guo, and TBA

TITLE

TBD

DURATION

The tutorial is half-day, including 180 miniutes presentation and discussion and 30 miniutes coffee break.

ORGANIZERS

TBA	
Jun Tao	University of Notre Dame
Hanqi Guo	Argonne National Laboratory

ABSTRACT

TBA

LEVEL

Intermediate/Advanced.

PREREQUISITE

A general understanding of flow fields and flow visualization, including basic concepts and techniques, such as different kinds of field lines, critical points, and particle tracing, etc.

AUDIENCE

The intended audience includes students, researchers and practitioners who are interested in the recent advances in flow visualization. More details to be added.

IMPORTANCE

TBA

SCHEDULE

Introduction	All	10 minutes
Talk1	TBD	40 minutes
Talk2	TBD	40 minutes
Break	———	30 minutes
Talk3	TBD	40 minutes
Talk4	TBD	40 minutes
Discussion	All	10 minutes

DESCRIPTION

The description and outline of each topic are presented as the followings:

Expressive Flow Field Exploration
Jun Tao

Abstract A major task of visualizing steady flow fields is to allow users perceive the flow patterns and locate features of interest. Traditional flow visualization approaches, such as *seed placement* and *streamline selection*, generate an appropriate set of streamlines to describe steady flow fields. However, only limited capabilities are provided to meet specific needs from different users, especially at the streamline segment level. In this talk, I will start from a unified framework that automatically selects best streamlines to display and selects best viewpoint to observe them simultaneously. Then, three interactive techniques will be presented to demonstrate the benefit of interactive exploration, including a graph-based technique to capture the relations among streamlines and spatial regions, a deformation framework to achieve focus+context visualization, and a vocabulary approach to query flow patterns in a textual manner.

Contribution This part of the tutorial focuses on the exploration of steady flow fields. Through the presented techniques, two trends of flow visualization are shown. First, user interactions are highly involved. This allows users to specify, identify and observe their interested patterns/features in a more desired way. Second, features are captured at both coarser and finer levels. Unlike most of the early works that treat each streamline as an entity, more local features residing on segments of streamlines can be compared, matched and discovered as well.

TUTORIAL NOTES

The tutorial notes will consist of the description of the tutorial, copies of the slides for each talk, and an extensive bibliography including specific references used in the tutorial as well as a general selection of relevant references.

SPEAKERS

The background of each speaker is listed in alphabetical order.

Hanqi Guo
Argonne National Laboratory

Hanqi Guo is a Postdoctral Appointee in the Mathematics and Computer Science Division, Argonne National Laboratory. He received his PhD degree in computer science from Peking University in 2014, and the BS degree in mathematics and applied mathematics from Beijing University of Posts and Telecommunications in 2009. His research interests are mainly on uncertainty visualization, flow visualization, and large-scale scientific data visualization.

FIVE RELEVANT PUBLICATIONS

H. Guo, W. He, T. Peterka, H.-W. Shen, S. M. Collis, and J. J. Helmus, "Finite-time lyapunov exponents and lagrangian coherent structures in uncertain unsteady flows," *IEEE Transactions on Visualization and Computer Graphics*, 2016, to appear.

R. Liu, H. Guo, J. Zhang, and X. Yuan, "Comparative visualization of vector field ensembles based on longest common subsequence," to appear, 2016.

H. Guo, J. Zhang, R. Liu, L. Liu, X. Yuan, J. Huang, X. Meng, and J. Pan, "Advection-based sparse data management for visualizing unsteady flow," *IEEE Transactions on Visualization and Computer Graphics*, vol. 20, no. 12, pp. 2555–2564, 2014.

H. Guo, X. Yuan, J. Huang, and X. Zhu, "Coupled ensemble flow line advection and analysis," *IEEE Transactions on Visualization and Computer Graphics*, vol. 19, no. 12, pp. 2733–2742, 2013.

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- *Hanqi Guo is with Argonne National Laboratory. Email: hguo@anl.gov.*

Jun Tao
University of Notre Dame

Jun Tao is currently a postdoctoral researcher at University of Notre Dame. He received a PhD degree in computer science from Michigan Technological University in 2015. His major research interest is scientific visualization, especially on applying information theory, optimization techniques, and topological analysis to flow visualization and multivariate data exploration. He is also interested in graph-based visualization, image collection visualization, and software visualization. He received the Deans Award for Outstanding Scholarship and the Finishing Fellowship at Michigan Technological University in 2015, and a Best Paper Award at IS&T/SPIE VDA 2013.

Five Relevant Publications

J. Tao, C. Wang, and C.-K. Shene, "Flowstring: Partial streamline matching using shape invariant similarity measure for exploratory flow visualization," in *Proceedings of IEEE Pacific Visualization Symposium*, Yokohama, Japan, 2014, pp. 9–16.

J. Tao, C. Wang, C.-K. Shene, and S. H. Kim, "A deformation framework for focus+context flow visualization," *IEEE Transactions on Visualization and Computer Graphics*, vol. 20, no. 1, pp. 42–55, 2014.

J. Tao, J. Ma, C. Wang, and C.-K. Shene, "A unified approach to streamline selection and viewpoint selection for 3D flow visualization," *IEEE Transactions on Visualization and Computer Graphics*, vol. 19, no. 3, pp. 393–406, 2013.

J. Tao, C. Wang, C.-K. Shene, and R. A. Shaw, "A vocabulary approach to partial streamline matching and exploratory flow visualization," *IEEE Transactions on Visualization and Computer Graphics*, vol. 22, no. 5, pp. 1503–1516, 2016.

M. Wang, J. Tao, J. Ma, Y. Shen, and C. Wang, "FlowVisual: A visualization app for teaching and understanding 3d flow field concepts," in *Proceedings of IS&T Conference on Visualization and Data Analysis*, San Francisco, CA, 2016.