How to Give a Good Scientific Talk

Dr. Vladislav Golyanik, MPI for Informatics

Computer Vision and Machine Learning for Computer Graphics
Seminar – Summer Term 2023
After you have read and understood the papers...
After you have read and understood the papers...

...you will have to present them.
Outline

* Structuring your story
* Preparing your data and information
* Preparing and giving the presentation
* Concluding your presentation
* Questions and answers
Presentation Structure :: Basic Rule

* Say what you are going to say (introduction)
* Say it (give the core talk)
* Say what you said (summarise and conclude)
Presentation Structure :: Basic Rule

* Say what you are going to say (introduction)
* Say it (give the core talk)
* Say what you said (summarise and conclude)

This is about scientific findings and implications:

*Do not try building suspense and then unveiling a surprise ending.*

Images: http://blogs.nature.com/naturejobs/2017/01/11/scientific-presentations-a-cheat-sheet/
https://www.barnesandnoble.com/blog/7-books-you-wont-believe-are-nonfiction/
The Story

* Structure and tell the story logically
* Exemplary structure of the presentation:
  + Title page (title, date, authors, venue, acknowledgements)
  + Seminar specifics: recap of the previous topic
  + Introduction / Motivation (including an overview and related works)
  + Approach (technical details of the method, maths)
  + Experimental Results (including evaluation methodology, interpretation of the results and discussion)
  + Conclusion (summary and core implications)
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Audience

* Why are you giving this presentation?
* To whom are you giving this presentation?
* What are your expectations from that talk?
* What are the expectations of the audience?
* Is the presentation live or online?
* How much time do I have?
Audience

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+ Keep that in mind while preparing the talk
+ Edit / adjust the slides
Audience :: University Seminar

* Audience with broad technical background
* Many topics: Provide an overview of state of the art
* Message:
  + Why the problem is important
  + Why the proposed solution is novel and impactful?
  + What are the main ideas and insights?
  + “Being a graduate student”: discussion, ideas for improvement
  + To include a slide or not: How important is it for the story? Will the audience understand and value the point?
Preparing the Talk :: Overview Figures

* A figure with a summary of findings, overview of the method, problem or a core concept
* Helps to motivate why the problem is important
* If you use web sources, reference the source

Mehta et al., SIGGRAPH 2017.
Luo et al., SIGGRAPH 2020.
Preparing the Talk :: Overview Figures

Textured mesh with skeleton rig

Intensity image stream

Event stream

Input

2D features at tracking fps

Event trajectory generation (Sec. 3.1)

Event trajectory

Detection

Batch optimization (Sec. 3.2)

Asynchronous and hybrid motion capture stage

Event-based pose refinement (Sec. 3.3)

Events

Boundary information

Output

Xu et al., CVPR 2020.
**Example :: What is a Qubit?**

**Qubit.** Quantum computing encompasses tasks which can be performed on quantum-mechanical systems [53]. Quantum *superposition* and *entanglement* are two forms of parallelism evidenced in quantum computers. A *qubit* is a quantum-mechanical equivalent of a classical bit. A qubit $|\phi\rangle$ — written in the *Dirac notation* — can be in the state $|0\rangle$, $|1\rangle$ or an arbitrary *superposition of both states* denoted by $|\phi\rangle = \alpha|0\rangle + \beta|1\rangle$, where $\alpha$ and $\beta$ are the (generally, complex) probability amplitudes satisfying $|\alpha|^2 + |\beta|^2 = 1$. In quantum computing, the state $\frac{|0\rangle + |1\rangle}{\sqrt{2}}$ denoted by $|+\rangle$ is often used for initialisation of a qubit register. The state of a qubit remains hidden during the entire computation and reveals when measured. If qubits are *entangled*, measuring one of them influences the measurement outcome of the other one [59]. During the measurement, the qubit’s state irreversibly collapses to one of the basis states $|0\rangle$ or $|1\rangle$. Efficient physical realisation of a qubit demand very low temperatures. Otherwise, thermal fluctuations will destroy it and lead to arbitrary changes of the measured qubit state.
HOW A QUANTUM COMPUTER WORKS

Principle of superposition allows parallelism in the calculations

Classical Bit
Binary system

Quantum bit “qubit”
Arbitrarily manipulable two-state quantum system

Superposition
Overlay of different states

Measuring
Clear definition of the state

Parallel arithmetic operations possible
Exponential multiplication per qubit
Massive amounts of data can be handled in plausible time

Example :: Overview Figures

Technical Drawings of da Vinci.

Harvey et al., SIGGRAPH 2020.

Cui et al., CVPR 2017.

Shimada et al., SIG’ASIA, 2020.

Mildenhall et al., ECCV, 2020.
## Using Tables

The table below shows the discharge of the Esopus Creek (Coldbrook, NY) and precipitation at Slide Mountain, NY (source: USGS/NCDC):

<table>
<thead>
<tr>
<th>Date</th>
<th>Discharge (cf/s)</th>
<th>Precipitation (in/day)</th>
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<tbody>
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<td>1-Nov</td>
<td>631</td>
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<tr>
<td>2-Nov</td>
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Discharge of the Esopus Creek (Coldbrook, NY) and precipitation at Slide Mountain, NY (source: USGS/NCDC)
Using Tables

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Discharge of the Esopus Creek (Coldbrook, NY) and precipitation at Slide Mountain, NY (source: USGS/NCDC)
\[ \mathcal{E}(T^1, T^2, \ldots, T^{\lfloor z \rfloor}, w) = \sum_{\zeta \in Z} \alpha_{\zeta} \mathcal{E}_{\text{data}}(T^{\zeta}) + \]
\[ + \sum_{\zeta \in Z} \beta_{\zeta} \mathcal{E}_{\text{plCP}}(T^{\zeta}) + \gamma_{\zeta} \sum_{\zeta \in Z} \mathcal{E}_{\text{reg.}}(T^{\zeta}, w) + \]
\[ + \eta \mathcal{E}_{\text{opt.}}(w) + \sum_{\zeta=3}^{\lfloor z \rfloor} \lambda_{\zeta} \mathcal{E}_{\text{c.}}(T^{\zeta}). \]
Using Maths

\[ \mathcal{E}(T^1, T^2, \ldots, T^{|Z|}, w) = \sum_{\zeta \in Z} \alpha_{\zeta} \mathcal{E}_{data}(T^\zeta) + \]
\[ + \sum_{\zeta \in Z} \beta_{\zeta} \mathcal{E}_{pICP}(T^\zeta) + \gamma_{\zeta} \sum_{\zeta \in Z} \mathcal{E}_{l.reg.}(T^\zeta, w) + \]
\[ + \eta \mathcal{E}_{r.opt.}(w) + \sum_{\zeta=3}^{|Z|} \lambda_{\zeta} \mathcal{E}_{c.}(T^\zeta). \]
Using Maths

\[ \mathcal{E}(T^1, T^2, \ldots, T^{\lfloor Z \rfloor}, w) = \sum_{\zeta \in \mathcal{Z}} \alpha_{\zeta} \mathcal{E}_{\text{data}}(T^\zeta) + \]

\[ + \sum_{\zeta \in \mathcal{Z}} \beta_{\zeta} \mathcal{E}_{\text{pICP}}(T^\zeta) + \gamma_{\zeta} \sum_{\zeta \in \mathcal{Z}} \mathcal{E}_{\text{reg}}(T^\zeta, w) + \]

\[ + \eta \mathcal{E}_{\text{opt}}(w) + \sum_{\zeta = 3} |\mathcal{Z}| \lambda_{\zeta} \mathcal{E}_c(T^\zeta). \]

* use equations at little as possible and as much as needed

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vector of frame-to-frame segment transformations

segment-to-segment connectivity weights

brightness constancy

projective ICP

lifted segment pose regularizer

robust weight optimizer

multiframe pose concatenation

optimization over multiple frames

max planck institut
Using Maths

\[ E_{\text{traj}}(\theta, z) = \left\| (1_T \otimes \bar{S}) + f_\theta(z) - (\Phi \otimes I_3)A \right\|_\varepsilon, \quad \Phi = \begin{pmatrix} \phi_{1,1} & \cdots & \phi_{1,K} \\ \vdots & \ddots & \vdots \\ \phi_{T,1} & \cdots & \phi_{T,K} \end{pmatrix} \]

\[
\begin{align*}
S & \quad \Theta \\
3P \times P & \quad 3F \times 3K & \quad 3K' \times F
\end{align*}
\]
Using Maths

\[ E_{\text{traj}}(\theta, z) = \| (1_T \otimes \bar{S}) + f_\theta(z) - (\Phi \otimes I_3)A \|_c, \quad \Phi = \begin{pmatrix} \phi_{1,1} \cdots \phi_{1,K} \\ \vdots \cdots \vdots \\ \phi_{T,1} \cdots \phi_{T,K} \end{pmatrix} \]

\[ E_{\text{smap}}(\theta, z) = \sum_{t=0}^{T-1} \sum_{p \in S_t} \left\| p - \frac{1}{|N(p)|} \sum_{q \in N(p)} q \right\|_1 - \lambda \sum_{t=1}^{T} \| P_z(G_tS_t) \|_2 \]

Laplacian smoothing
depth control

Sidhu et al., ECCV, 2020.
General Rule :: Presenting Methodology

* A scientific talk is always about

**HOW and WHY**

* Explain what you do
* What is new and innovative
* **AND** motivate why this is the way to go
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HOW and WHY

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THIS INFLUENCES THE STORY
Preparing and Polishing Presentation

* Use 3-7 bullets per page
  + avoid writing out complete sentences
* No more than one minute per slide on average
* Check the slide appearance consistency
* No sound unless it is part of results
* Videos are often results in visual computing
* Spelling and writing style
  + Use the same font (or a few fonts)
  + Check the text for typos; check the grammar
  + Decide between British and American English, and use the chosen language consistently

Preparing Yourself

* The way how you present yourself is as important as your slides
* Immerse yourself in what you are going to say
* Make sure that you are familiar with the equipment, check your equipment (microphone, etc.)
Preparing Yourself

* The way how you present yourself is as important as your slides
* Immerse yourself in what you are going to say
* Make sure that you are familiar with the equipment, check your equipment (microphone, etc.)
* Perception of gestures and body language
  + Eye contact with the audience
  + Use intonation in combination with the visual tools (e.g., colours)
  + Rehearsing is very important! Be on time, know what you want to say, prepare transitions between the slides/papers

Image: https://medium.com/@indiayuvagi/body-language-in-daily-life-ac75ff6f2453
Rehearsing

* Practice – actually stand up and say the words out loud
  - discover what you do not understand and develop a natural flow
* Do not memorise the talk, do not over-rehearse
* Stay within the time limit
* The Feynman Technique: a mental model and a breakdown of the thought process to convey information using concise thoughts and simple language [1].

Rehearsing

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* The Feynman Technique: *a mental model and a breakdown of the thought process to convey information using concise thoughts and simple language* [1].

*If you can't explain it simply, you don't understand it well enough.*

A. Einstein.

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Presenting

* Make yourself comfortable, speak freely, be enthusiastic but do not rush
* Ensure that people can hear you well and see your shared screen
Presenting

* Make yourself comfortable, speak freely, be enthusiastic but do not rush
* Ensure that people can hear you well and see your shared screen
* Starting is the most difficult part
  + memorise the first lines
* Nervousness is normal, don’t worry about stopping to think

https://mindthegraph.com/blog/scientific-presentation/
Concluding the Presentation

* Announce the ending so that people are prepared
* Have only a few concluding statements (the core points)
* Come back to the big picture and summarize the significance of your work in that context
* Open up new perspective (could be another slide)
  + describe future work
  + raise questions and potential implications
* Think carefully about the final words (which people tend to memorise)
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* Think carefully about the final words (which people tend to memorise)
* Seminar specifics:
  + compare two papers
  + common conclusion for both papers
  + present own ideas
Questions and Answers

* Difficult questions can help improving your skills, writing and research
  + Identifies parts the audience did not understand
  + Focuses and adds an additional dimension to your analysis
* You can repeat the question using your own words
  + This gives you time to think
  + Helps in understanding the question by more people
  + Presents an opportunity for clarification
* Be concise in your answers, do not drift away
* Anticipate questions, prepare backup slides if required
* Do not say that the question is bad or it has been already addressed
* Never demean the question or questioner
Moderating the Discussion

* You will be assigned as a moderator and get a set of questions one day before the appointment
* Most probably, some questions will be already addressed; all questions cannot be addressed due to time limits
  + 2-4 questions to each paper, up to 2 questions to both papers
  + you decide which questions are the most relevant and engaging
* Prepare a set of points to discuss
  + Weaknesses / Limitations of the methods
  + Comparisons between the papers
  + Ask other participants about their ideas
  + Build bridges to other talks in the seminar
  + Points you were unclear about while reading the papers
Conclusions

* Structure your content in a way that is comfortable for you and your audience
* Filter out core aspects and build convincing story
* Use figures, videos and maths appropriately
* Rehearse and present within the time limit
* Be prepared for questions
12 Rules for a Bad Talk

* Cram as much onto each slide as you can
* Use tables with lots of data
* Make your plots really complex
* Use as many slides as possible
* Embrace obfuscation
* Over-run your time

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Materials Used

This talk is a revised version of
How to Give a Good Scientific Talk by C. Theobalt, 2017.
Some ideas are from
How to Give a Good Talk by S. Pfirman (Cornell University) and
How to give Scientific Presentations by T. Williams (Texas A&M University).
Thank You!