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|  | **DEPARTMENT OF**  **COMPUTER ENGINEERING** |

CENG 49x - Computer Engineering Design

Project Proposal Form

# Important Notes

1. Please read carefully, and follow the instructions below to fill in this form.
2. A project could be proposed by (i) a student or a student group, (ii) a company, or (iii) a faculty member of the department by filling in this form and submitting it to [49x-proposal@ceng.metu.edu.tr](mailto:49x-proposal@ceng.metu.edu.tr) by e-mail. For a project proposal, there might be a sponsoring company supporting the project and providing some form(s) of resources for the project.
3. Each project will be carried out by a group of 4 students over the course of 7.5 months, which amounts to 30 person\*months. It is very important that your project's workload is around 30 person\*months. Please make sure that you have at least a rough justification about the workload of the project.
4. If your proposal might contain a patentable idea or any type of intellectual property, please first make sure to follow the appropriate steps (apply for a patent, etc.) before sending your idea to us. Once this form is received from you, the instructor(s) and the department has no responsibility regarding the intellectual properties of your project/idea.
5. All sources and documentation developed for this course are assumed to be public domain (GPL, CC or similar license) by default. If you need any exception for license and disclosure of project work, please specify this in detail in “Intellectual Property” section of the form.
6. Please note that source codes, documents and issue tracking will be kept in department servers. No restrictions can be requested for limiting faculty and assistants access to student work.
7. Instructions to fill in this form are given in italic fonts and in parentheses. To provide an input for a section of the form, delete the instruction and provide your input in place of the deleted instruction. In the final form that you will submit, there shouldn’t be any instructions left over.
8. If you feel that a particular instruction is not relevant to your project proposal, please use a proper explanation for this, rather than ignoring the instruction.
9. The final form should not exceed 5 pages including everything (even this page). Please use Arial, Normal, 11pt fonts and single line spacing.

# Acronym and Title

*MobileSR*

# Target

[x] This proposal can be announced to all student groups. It can be assigned to any student group.

[ ] This proposal is restricted to the following students/groups.

# Proposer Information

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| Names(s): | Academic advisor: Asst. Prof. R. Gökberk Cinbiş (METU) |
| Email(s): | Gökberk Cinbiş - [gcinbis@ceng.metu.edu.tr](mailto:gcinbis@ceng.metu.edu.tr) |

# Supervisor

*(Each project will be supervised by a faculty member of the Department of Computer Engineering, METU, throughout the academic year. Please mark the following options regarding the supervisor. Please only choose the first option if the supervisor has agreed. If you choose the second option, you can give a list of faculty members as suggestions.)*

[x] The project will be supervised by Asst. Prof. R. Gökberk Cinbiş.

[ ] The project can be supervised by any faculty member. Suggestions: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Project Description

*(Describe the end-product of your project and provide major usage scenarios.)*

*(What are the major technical aspects of the project?)*

This project aims to develop a deep learning based single-image super-resolution tool for mobile phones. The final product will enable applying a state-of-the-art super resolution algorithm to the images available on the phone gallery, towards enhancing the image browsing experience.

Importantly, the goal is to build up an efficient algorithm & program that quickly generates the super resolution (SR) result, on possibly already relatively high-resolution images without encountering memory issues.

# Tentative Plan

*(What are the major workpackages of your project?)*

*(How many person\*month will each workpackage take?)*

*(In which order the workpackages should be implemented?)*

WP1: Finalization of the software specifications. [4 PM]

WP2: Application interface design. [4 PM]

WP3: Main App interface implementation. [6 PM]

WP4: Investigation of the state-of-the-art in Super Resolution and mainstream techniques [4 PM]

WP5: A basic Deep Learning based SR model development (and training). [6 PM]

WP6: Integration of the SR model into the application. [6 PM]

# Similar Products/Projects

*(Search and identify similar products and/or projects, and provide brief information about them.)*

*(Provide references for those existing solutions including their web URLs in the “References” section.)*

There are few single-image super-resolution apps on the Play Store & iTunes app markets. However, nearly all of them have significant disadvantages that greatly limit their use their usability in practice, such as:

- dependence on taking multiple pictures (leads to motion blur)

- long processing time

- lack of an intuitive interface and/or significant limitations in functionality (e.g., lack of a save functionality)

- dependence on RAW images (existing JPEG images cannot be utilized).

The URLs of several existing Apps are listed at the of this document.

# Contributions, Innovation and Originality Aspects of the Project

*(State innovation and originality aspects as well as contributions planned in the project.)*

As mentioned above, the existing mobile apps are limited in various ways, which leads to their poor adoption in practice. The goal is to develop a light-weight and reliable SR model and construct a fast SR mobile app based on it.

Towards handling large images, the large images need to be tiled into small parts and processed independently in an efficient manner (by jointly running the SR algorithm on multiple tiles).

To speed up the processing time, the goal is to develop an appropriate light-weight deep learning-based SR model and implement its execution using the GPUs on the mobile devices.

# Success Measures

*(Provide a list of tangible success measures.)*

\* The demonstration of the ability to produce plausible SR images.

\* The demonstration of fast processing time: processing a 10 MP input image should be done within an acceptable amount of time (up to 10 seconds).

# Project Development Environment

*(State the planned hardware / software technologies and programming languages to be used.)*

*(State the planned methods, tools and techniques to be used.)*

Python will be used for prototyping. TensorFlow or Caffe2 deep learning frameworks will be utilized for integration into the mobile app.

# External Support

*(List any required hardware and software support for your project. State which ones will be provided by the proposer (if needed))*

*(Do you plan to utilize external support including know-how, consultancy services, etc. for some minor parts of the project?)*

*(State the data needed for the project (e.g. for machine learning). Indicate whether the data will be provided by the proposer or it will be collected as a part of the project.)*

The proposer (Gokberk Cinbis) will provide partial guidance regarding SR algorithms and deep learning models. However, the project group should be willing to learn the deep learning basics, do research, read papers and investigate various related technologies on their own.

Development towards Apple devices is preferred due to technical reasons; however, the target device will not be provided by the department, ie. the group members need to utilize their own hardware.

GPUs may be needed for training novel SR models. The proposer does not guarantee providing hardware support on this end. However, the project members may consider utilizing existing free GPU resources, such as Google’s colab.

Existing public datasets are expected to be sufficient.

# Intellectual Property Information

*(Include information about how the project group -and possibly the sponsor- agreed on the intellectual property rights of the end-products –if any.)*

The students and the proposer (ie. academic advisor) will individually have IP rights to (re)-use and/or modify and/or share the project material (concepts, algorithms, source code, program, etc.) without restrictions, unless a separate written agreement is made among the developers and the proposer. In case a publication made from the project material, the students contributing to the paper (in terms of research content) will receive credit.

# Major Risks and Risk Plan

*(State the major risks for the success of project and briefly explain a contingency plan if the risk occurs.)*

Learning deep learning fundamentals and understanding deep learning based SR algorithms may take more time than anticipated. If this occurs, the available time for developing (novel) SR algorithms may diminish. This is unlikely to cause a failure in the project completely, however, the final product may be less appealing (e.g., slower) than desired.

# References

*(Please provide references / links (URLs) for your answers in above sections.)*

[*https://play.google.com/store/apps/details?id=uk.tensorzoom*](https://play.google.com/store/apps/details?id=uk.tensorzoom)

[*https://play.google.com/store/apps/details?id=com.anforapps.camerasuperpixel*](https://play.google.com/store/apps/details?id=com.anforapps.camerasuperpixel)

[*https://play.google.com/store/apps/details?id=alpacasoft.enlargecorrectimage*](https://play.google.com/store/apps/details?id=alpacasoft.enlargecorrectimage)

[*https://play.google.com/store/apps/details?id=com.kaede\_software.superresolutionwaifu2x*](https://play.google.com/store/apps/details?id=com.kaede_software.superresolutionwaifu2x)

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[*https://itunes.apple.com/us/app/xtele-zoom/id1189050574?mt=8*](https://itunes.apple.com/us/app/xtele-zoom/id1189050574?mt=8)

[*https://itunes.apple.com/us/app/primecam-true-hdr-super-resolution-noise-reduction/id1007054053?mt=8*](https://itunes.apple.com/us/app/primecam-true-hdr-super-resolution-noise-reduction/id1007054053?mt=8)

*/\* End of the proposal \*/*