

## STATUS REPORT

|               |                                      |                 |                    |
|---------------|--------------------------------------|-----------------|--------------------|
| Organisation: | NHK (Japan Broadcasting Corporation) |                 |                    |
| Period:       | Sep.2023 - Aug.2024                  | Date of Report: | September 30, 2024 |

### PART A

#### Technical Developments during the past year:

- System upgrades/changes to practices for improved quality/efficiency

##### **Objective Evaluation System for 2K Video Quality Transcoded from 4K Source Using Dynamic Thresholds and Statistical Method**

Video files often use compression encoding, which can degrade image quality. Quality assurance is crucial in video production to maintain high standards. Established metrics like PSNR and ITU-T J.144 are used to assess video quality but are limited to comparing images with the same resolution. Therefore, human operators must expend real-time effort on reviewing both 4K and 2K videos during packaging before broadcasting or distribution, lowering the productivity of integrated 4K/2K simal productions.

To address this, we have devised and prototyped an innovative method for the automatic evaluation of 2K video quality transcoded from 4K. Specifically, to enable pixel-by-pixel comparisons between 4K and 2K videos, a spatial two-dimensional filter is employed for predicting reference pixel values for every pixel in the 2K video, derived from multiple pixels in the original 4K video. These predicted reference pixel values were compared with the actual pixel values of the 2K video, thereby enabling the calculation of international standard image quality metrics such as PSNR and the identification of quality anomalies.

Videos with complex spatial and temporal features can degrade image quality metrics, leading to false alarms even with correct resolution conversion. To address this, we adjusted our detection thresholds for quality anomalies, incorporating indicators of complexity. For detecting noise in specific regions of the 2K video, we used small-area PSNR as a metric. However, this metric can degrade in complex scenes, increasing false detections, many of which are imperceptible to humans. To enhance accuracy in such scenarios, we developed a statistical method for detecting quality anomalies.

Accordingly, the automated quality check of 2K content can now match or surpass the accuracy of human previews. This advancement reduces the significant cost and effort associated with traditional human review, resulting in both increased productivity and quality assurance in integrated 4K/2K simal productions.

- New Services/new projects initiated

##### **Initiative to Secure Content Reliability — Use of Content Credentials**

The rapid advancement of generative AI, which can create realistic images and audio, has led to the spread of fake news, raising global concerns about the reliability of online content.

Broadcasting stations, increasingly using the internet to distribute content, face risks of third parties using generative AI to alter content or spread misinformation under the guise of the station. Additionally, there is a risk that AI-generated media could be unknowingly used in news and programs.

To address these issues, NHK is developing technology to add “provenance information” to pieces of content, indicating when, by whom, and how they were created or edited. In 2022, NHK began exploring the use of provenance information in broadcasting services and joined the international standardization body C2PA in 2023. C2PA specifications involve adding metadata to content, verified through digital signatures, to detect any post-creation alterations.

NHK has developed a new TV video player adhering to C2PA specifications displaying provenance information to help viewers assess content reliability. The player checks for provenance

information and verifies signatures, displaying results to the viewer. If the content lacks provenance information or verification fails, the player alerts the viewer to potential tampering. Provenance information is also being considered for use in the production process to streamline the verification of media materials, particularly those created with generative AI. NHK is developing software that uses C2PA provenance information to reduce the effort required to verify the authenticity of media materials.

- Research projects

### **Sentiment Analysis Technology for the Purpose of Social Media Public Opinion Analysis**

We are working on sentiment analysis technology to improve social media public opinion analysis by accurately recognizing emotions in social media posts.

Since there are many short posts on social media, the existing discriminative models, which uses only the target utterances as input, was unable to demonstrate high recognition performance. A new method combines a database for similar case searches with existing models to improve emotion recognition performance. As a result of experiments for evaluating this proposed method, two of the three datasets commonly used for setting emotion recognition problems showed better recognition performance over the existing method, confirming the effectiveness.

We aim to further enhance recognition performance and implement these technologies in social media public opinion analysis.

[https://www.nhk.or.jp/strl/english/publica/giken\\_dayori/229/5.html](https://www.nhk.or.jp/strl/english/publica/giken_dayori/229/5.html)

### **Sign Language CG Generation Technology for News Content**

We are researching and developing technologies to translate Japanese news scripts into sign language and generate CG animations.

We have developed two technologies to generate a new sign language motion without an additional motion capture system: a method utilizing a diffusion model, which is a generative AI, and a method synthesizing basic movements motion that are already in the dictionary.

In order to more accurately reproduce the shape of the mouth and facial expressions that are important in sign language, a new facial model and a facial expression control technique based on image analysis has been introduced, resulting in greater expressiveness.

By performing image analysis of sign language videos from the "Sign-language News" program, a technology to automatically transcribe sign words according to word order has been developed. This makes it possible to streamline the work of creating a parallel corpus, which has been previously done manually.

A sign language CG production system for breaking news will be developed by 2025, aiming to put sign language CG services into practical use while incorporating opinions of deaf and hard of hearing people.

<https://www.nhk.or.jp/strl/english/open2024/tenji/2/index.html>

- Internet and Mobile Broadcasting Services

### **Live Closed Caption Synchronization System for Internet Distribution**

In live broadcasts such as news programs, closed captions are displayed with a delay relative to the audio. This is because it takes several seconds to tens of seconds of work time to generate captions. Therefore, people with hearing disabilities have difficulty accurately understanding the program or enjoying watching it together with non-disabled people. To address this issue, we have developed a live closed caption synchronization system for internet distribution.

This system takes advantage of the inherent delay of internet distribution of videos, namely the time lag required for encoding processing when generating distribution files. The simultaneous internet distribution of broadcast programs in the "NHK Plus" service has a delay of approximately 30 seconds relative to the broadcast.

This system estimates the actual speaking time by text-matching live closed caption data multiplexed on SDI signals with voice recognition results. By adjusting the display time according to the results, captions can be displayed almost perfectly synchronized with the audio distributed on the internet.

By combining NHK's voice recognition engine and N-gram search algorithm with our unique scoring process that determines the certainty of recognition results, we can correct display times with high accuracy.

This system was introduced for the catch-up distribution programs (VOD) in 2020, but we started applying the system to the simultaneous distribution of main nationwide news programs in January 2024.

|                         |                           |                  | Radio                                          | Television                                                                     |
|-------------------------|---------------------------|------------------|------------------------------------------------|--------------------------------------------------------------------------------|
| Coverage %              |                           |                  | MF<br>Radio1:99.9%<br>Radio2:99.9%<br>FM:98.0% | Digital Terrestrial:98.2%                                                      |
| Programme Channels      |                           |                  | AM Radio:2<br>FM Radio:1                       | Digital terrestrial:2<br>Digital Satellite (HD):1<br>Digital Satellite (UHD):2 |
| Studios (Production)    | File-based Set-up         | R/N/D            |                                                |                                                                                |
|                         | SDTV                      | R/N/D            |                                                |                                                                                |
|                         | HDTV                      | R/N/D            |                                                |                                                                                |
|                         | UHDTV                     |                  |                                                |                                                                                |
|                         | IP Based Set-up           | R/N/D            |                                                |                                                                                |
| Transmission & Delivery | HF                        | <del>R/N/D</del> | 3                                              |                                                                                |
|                         | MF                        | <del>R/N/D</del> | Radio1 :281<br>Radio2 :146                     |                                                                                |
|                         | FM                        | <del>R/N/D</del> | 532                                            |                                                                                |
|                         | TV                        | <del>R/N/D</del> |                                                | Digital :2,214                                                                 |
|                         | OTT/IBB/Internet Services | <del>R/N/D</del> |                                                |                                                                                |
|                         | Mobile Services           | <del>R/N/D</del> |                                                |                                                                                |

R = Replacement/upgrade

N = New

D = Discontinued

**PART B**  
**CURRENT ACTIVITIES**

|    | Activities                                                                                                                                            | Area       | Brief Details:<br>1. Objectives<br>2. Progress to date | Challenges/Problems Faced:<br>1. Lack of resources<br>2. Lack of know-how<br>3. Others (e.g. up-skilling) | Solutions Implemented/Type of assistance requirement from ABU |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| 1. | Development projects/Upgrading facilities/Training                                                                                                    |            |                                                        |                                                                                                           |                                                               |
|    |                                                                                                                                                       |            |                                                        |                                                                                                           |                                                               |
|    |                                                                                                                                                       |            |                                                        |                                                                                                           |                                                               |
|    |                                                                                                                                                       |            |                                                        |                                                                                                           |                                                               |
| 2. | Participation in ABU Activities                                                                                                                       | Area       | Level of Participation                                 | Reasons for not participating (though interested)                                                         |                                                               |
|    |                                                                                                                                                       |            |                                                        |                                                                                                           |                                                               |
|    |                                                                                                                                                       |            |                                                        |                                                                                                           |                                                               |
|    |                                                                                                                                                       |            |                                                        |                                                                                                           |                                                               |
| 3. | Suggestions for New ABU Activities e.g. study topic projects, webinars, workshops, symposiums etc, spectrum activities, information exchange platform | Activity 1 |                                                        |                                                                                                           |                                                               |
|    |                                                                                                                                                       | Activity 2 |                                                        |                                                                                                           |                                                               |
|    |                                                                                                                                                       | Activity 3 |                                                        |                                                                                                           |                                                               |